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Social Imports of Invention

IN his presidential address to the British Association at Blackpool in 1936, Sir Josiah Stamp, discussing the impact of science upon society, stressed the need for a technique of social adjustment. The soundness of this plea has been emphasized in many subsequent discussions on the relations between science and society and has been confirmed by evidence afforded in such reports as those of the Commissioners for the Special Areas or the surveys of such areas; for example, that of South Wales conducted by the University College, Cardiff.

Despite growing recognition of the importance of some attempt to devise more systematic means of using technical discoveries and improvements and to foresee their direct and indirect effects, there has as yet appeared in Great Britain, however, no systematic study of the direct or indirect repercussions of the impact of invention upon society. The report on "Technological Trends and their Social Implications" (Washington: U.S. Government Printing Office. 1 dollar) which the United States National Resources Committee published in June of last year is accordingly the more welcome, and in issuing an admirable summary of this six hundred page report, Political and Economic Planning (Broadsheet No. 111) has again earned the thanks of all who are considering the problems which arise from the impact of science upon society.

The report in question was prepared by a special scientific sub-committee and represents a major attempt to forecast the limits of new inventions which may affect living and working conditions in the United States in the next ten to twenty-five years. It indicates some of the problems inevitably involved in the adoption and use of these inventions and emphasizes the importance of national efforts to bring about prompt adjustment to those changing situations with the least possible social suffering and loss, and sketches some of the lines of national policy required.

Much of the matter contained in the report is relevant to European as well as to American conditions, and the lack of attention which the report has received is a further indication of the absence of effective means for the exchange of information and the interpenetration of thought on problems of common concern to the two chief English-speaking democracies. PEP itself is indeed now attempting to improve such contact by exchanging publications with a number of leading American organizations concerned with planning and public affairs. The growing importance of close and effective relations between Great Britain and the United States demands the extension and encouragement of any means to that end.

The possibility of forecasting the impact of technical inventions on society has been widely discussed, and its many pitfalls have been emphasized repeatedly. The present report, however, while not overlooking these difficulties, distinctly emphasizes the practical possibility of such forecasting and of avoiding many of the most obstinate problems with which their indirect effects have confronted Governments. The impact of inventions never comes instantaneously without signals, and on an average is spread over a period of about thirty years. Moreover, there are three distinct aspects of prediction. It may be possible to forecast in which industries and processes invention is most likely to occur on a considerable scale, which industries are most likely to be affected economically by the impact and what repercussions are most likely elsewhere.

For the technician, the first of these aspects is

the most interesting, but for the community, the third and to a lesser extent the second are of more direct and immediate concern. If, however, the work of inventors is to be followed from a broader social and economic point of view, so that opportunities for anticipating and meeting the subsequent repercussions are used, we must have administrators competent to recognize and take account of the scientific and technical factors involved. That this aspect of the impact of invention should be seriously considered is the more important because, as the report indicates, not only is the number of inventions made each year likely to increase rather than to diminish, but also in spite of the difficulty of predicting the effects of specific inventions, it is much easier to forecast the broad social impacts of invention as a whole, since clusters of inventions after all lead to the same social end. For example, the telephone, broadcasting and television all tend to break down individual isolation and privacy, while motor transport, railway electrification, telephones, radio, the cinema and the chain store have all tended to encourage a suburban type of development.

There is, indeed, little information that is new in the present report, but it establishes very clearly the principle that it is a function of Government to watch over and adjust the serious strains and friction which invention may set up in society, while its recommendations for a permanent mechanism for giving effect to this principle deserve study.

In modern industry itself, inventions to-day have four characteristic social tendencies: continuous processes, automatic operation, use of registering devices and use of controlling devices. All of them tend towards the displacement of labour or making a job more mechanical or monotonous, though quite often a few highly skilled or intelligent workers are required as a result in place of many unskilled or manual labourers. Thus, although one result of mechanical invention may be that the more arduous and unpleasant tasks to be performed by manual labour are considerably reduced in number or can be performed by far fewer operators under pleasanter or less exacting conditions, this advantage must be set against the possible effects on displaced workers if no fresh employment is found for them.

Once again, therefore, we are concerned with a net social effect or with the integration of the social consequences of the invention or discovery both direct and indirect. It is precisely such reasons as these which have given a new impetus to social science and research, and to the attempt to plan the utilization of national resources on scientific lines. Moreover, if, as Dr. Ogburn suggests, the lag between invention and its impact on the community makes invention a social barometer, it is the more important that every effort should be made to read that barometer. It is highly probable, for example, that new developments in industry will threaten the existence of a number of skilled occupations, and unless the adoption of fresh methods is carefully adjusted to recruiting policy, and suitable schemes of compensation and retraining for the displaced workers are enforced, much friction will result.

The argument for the extension of scientific planning advanced by this report accordingly rests essentially on human considerations. Scientific planning as suggested here, the application of scientific methods in an ever-widening field of social and economic problems, is not the handling of human affairs in the cold dispassionate sphere of reason and mechanical efficiency with disregard of human emotions and suffering. On the contrary, it seeks to eliminate the selfish direction of industrial undertakings with regard merely to the financial advantage or mechanical efficiency of a single enterprise, and to insist that account shall be taken not merely of the well-being of the employees of the concern itself but also of the welfare of the industry and the nation as a whole.

The report opens up whole fields of research for applied psychology, and if it says little or nothing about that aspect of invention which has perhaps the first claims on the interest of scientific workers, namely, the conditions most conducive to creative thought and fecund research, its concrete proposals in themselves include some special studies of a few inventions likely to be widely used with important social consequence. Among these are the establishment of federal committees on technological unemployment, departmental science committees to investigate and report regularly on the progress and trends of science and invention and their possible social and economic effects, and a review of the whole working of the patent laws, with a view to adaptation to contemporary needs. It is indeed to be hoped that scientific workers and others will be quick to grasp the significance of this report and the challenge it offers to constructive effort no less in Great Britain than in the other English-speaking democracy to which it was primarily addressed.

Procreative Beliefs of the Australian Aborigines

Coming into being among the Australian Aborigines:
a Study of the Procreative Beliefs of the Native Tribes of Australia. By Prof. M. F. Ashley-Montagu. Pp. xxxvi + 362 + 4 plates. (London: George Routledge and Sons, Ltd., 1937.) 21*s.* net.

IN 1899 Spencer and Gillen, writing about the Arunta tribe of Australia, declared that the natives possessed no knowledge whatsoever of the relationship between coitus and pregnancy, and in the early years of this century this gave rise to an extensive controversial literature. Prof. Ashley-Montagu takes up the subject again, and reprints and discusses in his book all the directly relevant records in ethnographical literature. His thesis is "that in Australia, practically universally, according to orthodox belief, pregnancy is regarded as causally unconnected with intercourse". The argument and its conclusion assume a distinction between 'orthodox' belief and what Prof. B. Malinowski in his foreword calls "random statements of irrelevant opinion", but no objective criterion is offered by which to distinguish these different kinds of beliefs. The argument is also vitiated by the fact that the author never makes clear what he means by "causally connected". Thus he accepts (p. 168) the statement of Miss McConnel (which is supported by a myth) that in a Queensland tribe sexual intercourse is regarded as a necessary condition of conception, and then writes, "the important point of course here is that these natives do not regard intercourse as the cause of conception but only as a condition thereof". Since for the modern scientific investigator coitus is a necessary but not a sufficient condition of pregnancy it is difficult to understand what is the nature of that "causal connection" of which the Australians are said to be ignorant. But the author is not consistent, since (on p. 237) he says that for the Australian native sexual intercourse "positively has no connection with childbirth".

There is good evidence from recent field-work that in a number of Australian tribes there is a recognition of some connexion between sexual intercourse and childbirth. Most of the work during the last ten years has been carried out in the northern part of the continent, since it is there that are to be found the tribes that have not been destroyed by white invasion. Prof. Ashley-Montagu, in order to maintain his thesis, treats these tribes as "aberrant" and writes: "there is every reason to believe that the beliefs of the tribes in this general region are not strictly indigenous, that there is some evidence that they are of foreign origin, and that for this reason they cannot be regarded as strictly aboriginal Australian beliefs" (p. 113). But he adduces nothing that can properly be regarded as evidence for this view.

Another weakness of the argument is that the author, as he himself notes, takes the Arunta of the Alice Springs district as typical of the whole of Australia. What is typical of Australian tribes taken together is not anything found in any one particular tribe, but those general characteristics which are common to all or to the great majority. The Arunta have their own special beliefs about childbirth which are not shared by the majority of Australian tribes, and to take these as typical of the continent is invalid.

The author assumes that in their beliefs, or rather in their 'orthodox' beliefs, the Australian natives are logical and consistent. ("In his own thought the savage is perfectly logical", p. 340.) When, therefore, he finds in the accounts given of the beliefs of any tribe, things that seem to him inconsistent, he falls back on the distinction between 'orthodox' and other beliefs, or else treats the inconsistencies as if they arose, not from the statements of the natives themselves, but from the way in which they are reported by the ethnographer.

There doubtless is a certain kind and degree of consistency among the Australian beliefs, but it is not of the kind that the author has in mind. Many Australian tribes hold a belief that a woman becomes pregnant because a "spirit-child", as the native term is often translated, has entered into her. Prof. Ashley-Montagu accepts this as the 'orthodox' belief, and seems to think that people who hold it cannot also recognize any connexion between pregnancy and coitus. If we had no more knowledge about the beliefs of Roman Catholics than we have about those of the Australian aborigines, we should, by following the author's methods, conclude that the orthodox belief that every child born into the world is the result of a special act of creation by God is incompatible with the belief that the child results from the fertilization of an ovum by a spermatozoon. But we do in this instance know that the two beliefs are held together and are made consistent by the distinction between soul and body.

The dangerous unsoundness of Prof. Ashley-Montagu's simplistic, almost naïve, treatment of the Australian problem may be illustrated by yet

another instance from our own society. Anyone in modern Europe who believes that the human soul continues to exist after the death and dissolution of the body will be likely on certain occasions to deny that thought and feeling are dependent on physiological processes in the nervous system, yet will also on occasions recognize that it is through such physiological action that unconsciousness results from chloroform or a blow on the head. An inquiring anthropologist from another world using Prof. Ashley-Montagu's methods would conclude that in twentieth century England, according to orthodox belief, conscious thought is regarded as causally unconnected with the physiological functioning of the brain.

In Australian tribes the phenomena of pregnancy and childbirth are associated with a number of things, with menstruation and with menstrual blood and thereby with the moon, with the small whirlwinds that swirl across the country in hot weather, with rain as the primary source of fertility in Nature and with the rainbow-serpent in which the life-giving power of water is personified, with food, with dreams, with the totemic ancestors, with certain sacred spots (baby totem centres) at which members of the baby totem group perform ceremonies to produce a supply of babies in the tribe just as members of the kangaroo totem by similar ceremonies multiply the kangaroo. Many of these ideas are found associated together in a single tribe. They afford a means by which the Australian aborigines represent to themselves the place of childbirth in a complex order which is at one and the same time the social order and the natural order. In spite of the author's attempts to explain it away, there is clear evidence that in many tribes there is included in this set of ideas an association between childbirth and sexual intercourse. The anthropologist who knows his business is not disconcerted when he is told by the same informants that babies come from the moon, that pregnancy results from a woman eating food which makes her sick, that there would be no children if there was no copulation, and that to ensure a proper supply of babies it is necessary once a year to perform a ceremony at the baby totem centre. What is needed in a scientific treatment is an examination of what these associated ideas mean in the thinking and the behaviour of the natives themselves, not a discussion of them in terms of our own complex notion of efficient causation, which is a product of centuries of Aristotelian philosophy and of scientific and technological development. What consistencies and inconsistencies there are must also be studied in the minds of the natives themselves, not in terms of our own conceptions. To such a needed study the book under review makes no contribution of any value.

To his thesis that the Australian aborigines are ignorant of physiological paternity the author adds, in his thirteenth chapter, the thesis that they are also ignorant of "physiological maternity". What exactly he means by the latter thesis is even more obscure than what he means by the former. The writing throughout the book is awkward, and there are occasional faults of grammar. The map on p. 292 showing the distribution of subincision, taken from Basedow, is incorrect. There seem to be very few misprints; a line of type, seven from the bottom, has been dropped on page 260. The reviewer is unable to agree with the lavish, even extravagant, praise that is bestowed on the work by Prof. B. Malinowski in his foreword.

A. R. RADCLIFFE-BROWN.

The Newer Outlook on Animal Nutrition

Animal Nutrition

By Prof. Leonard A. Maynard. (McGraw-Hill Publications in the Agricultural Sciences.) Pp. xiv + 483. (New York and London: McGraw-Hill Book Co. Inc., 1937.) 24*s*.

AS the modern system of intensive production, calling for higher and higher milk yields or rapidity of growth, has developed, so not only have the demands of the animal for quantity of food increased, but also many new requirements as to the quality of the feed have been set up. Attention has therefore to be focused on special nutritive requirements previously unrecognized. It is especially in this respect that the book under notice extends the older works on animal nutrition.

Although the book is written primarily with application to farm animals, it does not deal with detailed feeding practices, as are already to be found in other books, but rather it seeks to show how the newer outlook on animal nutrition can assist these practices.

The subject is treated from the wide point of view of the comparative physiologist, both in obtaining general principles by a comparison of species and in the application of those principles to different species. This wider point of view is also seen in the chapters on growth, reproduction and lactation, in which the special nutritive requirements of these functions are considered in detail. Problems of intermediary metabolism

and the means by which the nutriment in the body is regulated to the different organs are involved.

The inorganic elements and the vitamins required by the body are treated at length, particularly in relation to deficiency diseases and to questions of improved health and efficiency in different species of animals. Several sections are devoted to the technical side of running nutritional experiments, such as the determination of digestibility, nutritional balances and respiration calorimeters, while others deal with some of the physico-chemical bases of the life-processes, such as the absorption of radiation.

Interesting accounts of recent work on various points of practical interest at the present time include such problems as the storage of iron by the fœtus during pregnancy in its connexion with the study of anæmia, the nutriments required for egg production, the effects of the method of preservation of greenstuffs on their vitamin content, the relation of food fat to depot fat, the role of water in the body, and particularly the experiments quoted on the effect of improvements in the nutritional regime in causing better physical development in animals and man.

As the book throughout contains references to the literature, often from reports of agricultural experiment stations and other scattered sources, it should prove very useful to those engaged in nutritional work. Brief historical accounts of noted names in nutritional science are given in footnotes. J. H.

Biological Positivism

The Axiomatic Method in Biology

By Dr. J. H. Woodger. With Appendices by Alfred Tarski and W. F. Floyd. Pp. x + 174. (Cambridge: At the University Press, 1937.) 12*s*. 6*d*. net.

DR. WOODGER'S book is an attempt to do for a part of biology what Whitehead and Russell, in "Principia Mathematica", did for mathematics. Starting from as small a number as possible of axioms and undefined terms, he proposes to deduce known biological generalizations, and to discover new ones by pure deduction. For this purpose he uses a special set of symbols, including many taken from Whitehead and Russell, and 125 new ones. Some of these, for example, **cell**, are undefined, whilst others, for example, **Ps**, meaning the relation of sexual parenthood, are defined in terms of cell lineages.

The author then arrives at a quasi-mathematics in which the fundamental operations are the division and fusion of cells, and the division of cell-parts, for example, genes. If any system conforms with his axioms, the theorems deduced will be true for it. Some of these theorems are applicable to taxonomy, some to embryology, but the majority to genetics. In this latter field, at any rate, Dr. Woodger's method is unsuited to deducing new results. Thus on p. 114 we are presented with an "unsolved problem", the solution of which can, however, be written down without difficulty by anyone familiar with Wright's mathematical methods.

This might not matter if the axioms used in deduction were biologically as well as logically correct. But they are not. Thus, on p. 70, **g** (for gamete) is defined as the class of cells which fuse in pairs to form a zygote (according to a restricted definition given earlier). Now a female cell which fuses with a male gamete may be a haploid (as in higher plants) or a diploid which only extrudes its second polar body after fertilization. Here an attempt to define gametes exclusively in terms of cell divisions and fusions leads to the loss of the fundamental distinction between diploid and haploid cells.

Again, on p. 92 in the definition of a "continuous component" of a cell series, it is apparently assumed that genes and chromosomes do not divide during the first meiotic division, which is therefore always reductional. This is known to be untrue. Hence not only is the whole subsequent genetical theory only proved for a non-existent class of organisms, but also any treatment of segregation in *Ascomycetes* becomes impossible.

It is perfectly true that both these mistakes occur in text-books of biology. But if Dr. Woodger's method is to be justified, it can only be on the ground of greater accuracy and rigour than are to be met with in current biological writing.

I believe that these errors arise from an attempt to be positivistic rather than materialistic. If we attempt, out of the inconceivable richness of biology, to concentrate on a few characters or processes which lend themselves readily to abstract description, we inevitably lose sight of biological realities. A classical example is the Linnæan system of flowering plants, logically perfect, but often at variance with the natural system based on community of descent.

In my own opinion, the attempt to fit the facts of life into any logistic scheme is likely, in the long

run, to be a failure. But it will be a useful failure if it serves to show up false assumptions which we tacitly make. Some, such as the existence of female gametes, are relatively trivial. Others are much more deeply involved in our thought, and if they are false the results are much more serious.

Thus, Dr. Woodger assumes that a cell can be divided into momentary parts, that is to say that in theory, at least, we can specify the state of a cell at any instant with no limit to our accuracy. This is untrue for an atom, and, if it is correct that change is part of the very essence of life, it may turn out to be even more glaringly untrue of the cell.

Again, it is assumed that certain cell-parts, for example, genes, are individuals each with one and only one ancestor at any past date. This assumption has so far satisfied geneticists. But actually when two like genes come together in a homozygote at pachytene, and after a time which may be as long as forty-five years, finally separate, it is impossible to say which of the separating genes represents a given one of the synapsing genes. The uncertainty may be small, but is not necessarily negligible, and may prove very important.

Similarly, it is assumed that genes divide. This may be true. It is equally plausible that they reproduce by copying rather than by division.

The value of Dr. Woodger's book will be greatly enhanced if he clears it, so far as possible, both from definite myths, such as that of the female gamete, and from postulations of unobserved phenomena, such as gene division. If this is done, his method may prove valuable for morphologists for some generations to come, although until it takes cognizance of chemical facts it will be of little use to the biologist and none to the biochemist. But at present it falls between the two stools of positivistic description and materialistic explanation. I believe that the former ideal is in the long run unattainable. But the attempt to attain it has inspired such biologically valuable work as that of Karl Pearson.

In his preface Dr. Woodger emphasizes the tentative character of his book. If it proves possible to rewrite it in terms of observable phenomena only, without such postulates as gene divisions and momentary states of cells, it will be a valuable contribution to human thought. Until then, its main importance may be to lay bare erroneous assumptions rather than to serve as the basis of a further theoretical construction. J. B. S. HALDANE.

Synaptic Transmission

Autonomic Neuro-Effector Systems

By Prof. Walter B. Cannon and Prof. Arturo Rosenblueth. (Experimental Biology Series.) Pp. xiv + 229. (New York: The Macmillan Co., 1937.) 17*s*. net.

SEVERAL reviews have been written recently dealing with the chemical transmission of nervous impulses. A monograph has now been published which gives, for the first time, an authoritative exposition of the views of the Harvard School. The authors have both written many papers describing investigations of the properties of adrenergic nerves. They have shown that stimulation of these nerves causes the liberation of at least two different substances. The clear presentation of the evidence for this conclusion forms the most valuable and impressive feature of the book. No one could question the experimental results, but their interpretation is still in doubt. The theory that drugs combine with a special receptive substance in the motor organ provides the only reasonable explanation of the specificity of drug action, but Cannon and Rosenblueth's theory that this receptive substance is liberated with the drug into the blood stream seems unnecessarily complicated, and has met with opposition.

The book is argumentative. The authors reject Bacq's rather factious criticisms of their theory of sympathins *E* and *I*. They reject the theory advanced by Monnier and Bacq to account for the failure of 933*F* to antagonize the effect of adrenergic nerves in favour of that advanced by Dale and Gaddum to account for similar phenomena in connexion with atropine. They reject the theory which explains dose-effect curves in terms of individual variations of the sensitivity of muscle elements on the ground that it would be necessary to assume that the logarithm of the sensitivity of these elements was normally distributed. This is not the weak point of the theory in question, since the logarithms of biological quantities usually *are* normally distributed. They accept the theory which regards these curves as hyperbolæ, and interprets them in terms of mass action, but do not appear to realize that, on this theory, the ratio to one another of the potency of two solutions must be independent of the size of the doses used.

This book is, in fact, likely to lead to much discussion. J. H. G.

The Camford Visitation

By H. G. Wells. Pp. 76. (London: Methuen and Co., Ltd., 1937.) 2*s*.

MR. WELLS'S address as president of the Educational Science Section of the British Association last year dealt with certain aspects of education in the schools only. In his latest story, with its cover of dark and light blue, he deals with university education and its place in society. The story begins with an amusing sketch of a dyed-in-the-wool scholar, the master of Holy Innocents College, a preserver of culture, of true scholarship, born to appreciate without ever creating. His breakfast oration has got to the stage of denouncing "the dictatorship of the half-educated. . . . We are being endowed, Sir, and told what to know and teach, by the unholy wealth of ironmongers and the overblown profits of syndicated shop-keepers." Then enters the visitant as a voice, an unseen presence, asking: "Half-educated? Now how can you measure education and divide it into halves and quarters? What do you *mean* by education? . . ." For the rest of the story the visitant subjects human life, and in particular its treatment by the University of Camford, to a sympathetic but quite unsparing scrutiny. The general thesis is an appeal to the universities to play a part in "so heroic an ordering of knowledge, so valiant a beating out of opinions, such a refreshment of teaching and such an organization of brains as will constitute a real and living world university, head, eyes and purpose for Man".

In the development of the thesis many topics are reviewed or touched, with Wellsian incisiveness and ironic humour—the claim that the humanities are wisdom and that science is not, the pseudo-scientific explanations of psycho-analysis, the fashionable philosophy-cum-politics-cum-religion called dialectical materialism. "To see a novel proposition pass through a Marxist gathering is like watching a breeze across a field of ripe corn. It passes, and the serried minds return to their upstanding integrity." Mr. Wells is here as stimulating, provocative and entertaining as ever, but the visitant treats university science teaching more kindly than we should have expected.

Out of my Life and Work

By Auguste Forel. Translated by Bernard Miall. Pp. 352+8 plates. (London: George Allen and Unwin, Ltd., 1937.) 16*s*. net.

THIS volume of memoirs deals with a full and varied life. Prof. Forel became a psychiatrist by profession and simultaneously was one of the leading European myrmecologists. A narrow and isolated early upbringing led him to take refuge in Nature around him and, before he was eight years old, he had become interested in ant life. Forel was destined for medicine, and he seems to have prosecuted his studies in this subject side by side with those on ants. Failure to pass the examinations at Zurich led to his transference to Vienna. Here he graduated and secured his first post, which was under Prof. Gudden in Munich.

Forel had been working for some time at his "Ants of Switzerland" and in 1875 this treatise received the Thore Prize of the Paris Academy of Sciences. In 1879 he became assistant physician at the Burghölzli Asylum, overlooking Lake Zurich. Here he remained for nearly twenty years, becoming its director, and also professor in the University of Zurich. His energies were devoted to research, teaching and treatment in connexion with insanity. His earlier studies on the brains of normal individuals and of mental deficients were followed by his development and application of hypnotic suggestion as a method of treatment. He tells much of his life at Burghölzli, of its trials, misunderstandings and successes; of his travels to other lands in order to further his studies of ants; of his politics and of his efforts as an uncompromising opponent of alcoholism; and of his life in retirement and its retrospection. These memories are written in a frank, unpretentious style, and reflect their author's efforts in recording the events of his life in their proper perspective. The work of translation has been ably done by Mr. Bernard Miall.

The Chromosomes

By M. J. D. White. (Methuen's Monographs on Biological Subjects.) Pp. viii+128. (London: Methuen and Co., Ltd., 1937.) 3*s*. 6*d*. net.

THIS competent book of 128 pages provides a guide to recent discoveries in cytology. It describes the phenomena of mitosis and meiosis, considers chromosomes in relation to evolution and does not shrink from invading the realms of advanced cytological theory. The book contains a curious mixture of well-written, easily understood remarks on advanced work, combined with involved descriptions of more elementary material. This is probably due to the author's endeavour to cover as much of the ground as possible in a small book.

A glossary is provided, but the definitions are not always strictly specific. The book is to be recommended to those who require a summary of the modern theories and discoveries of cytology and will undertake further reading of authorities in the excellent bibliography. F. W. S.

Life and Death:

the Autobiography of a Surgeon. By Prof. Andrea Majocchi. Translated by H. J. Stenning. Pp. 343. (London: George Allen and Unwin, Ltd., 1937.) 10*s*. 6*d*. net.

THE author of this temperamental book, which is obviously intended as much for the layman as for the medical reader, is professor of surgery at Milan and consultant to the Ospedale Maggiore. In addition to a short history of this hospital, the work contains a vivid description of the author's practice in the Obstetrical Department, his visits to the surgical clinics of Switzerland, the United States, Paris and Berlin, his War service at the Front and especially the treatment of wounds of the abdomen, brain and spinal cord and the "roses and thorns" of a surgeon's career. Chapters are also devoted to the nursing profession as seen through Italian spectacles, and a satirical account of a medical congress.

Soil Conservation in Tropical Africa

By Dr. L. Dudley Stamp, director of the Land Utilisation Survey of Britain

THE attention which has recently been given to the widespread and serious nature of soil erosion in the African continent has perhaps insufficiently emphasized two aspects of the problem. One is that the serious and rapid erosion is of recent growth—not only in large measure consequent upon the control of the continent by Europeans but also actually in danger of being increased by the very measures designed to combat it. The other is that the African cultivator has already evolved over large areas a system of farming designed to combat soil erosion and maintain soil fertility, and that the essential need is to encourage and develop this system rather than to supersede it. A recent tour in Nigeria has convinced me that the African system may hold the key to the solution of some of the most urgent problems of soil erosion in America and elsewhere.

Prior to the European partition of tropical Africa, internecine strife and the incidence of disease, both epidemic and otherwise, resulted naturally in a limitation of population and of any serious pressure on the land in purely agricultural areas, and prevented overstocking both by man and by animals on grazing land. Nowadays, population density in parts of Southern Nigeria reaches more than five hundred to the square mile, whilst the number of cattle in Kenya increased from three to six million between 1920 and 1936.

In Southern Nigeria, a land of adequate rainfall (60 to 150 inches or more), naturally clothed with high forest but where certainly less than one per cent of virgin forest remains, the land is divided up between the village communities. Each village tract—in other lands one would say parish—is held communally and farmed on a well-marked system of rotation, each family returning in the appropriate year to farm its own special portion. The system is often, though wrongly, referred to as 'shifting cultivation', and has even by foresters been called after the system of temporary mountain clearings in Burma a 'Taung-ya' system, which it certainly is not. It is best described as 'bush-fallowing', a period of cultivation being followed by a long period of fallow, the only difference from the fallows of temperate lands being that the forest trees form the 'weeds' of the fallows. Seven to ten years (during which the trees grow to thirty feet in height) may be regarded as the normal period of fallow; it is when the pressure on the land is such that the fallow period has to be reduced perhaps even to as little as two years that the system breaks down. When the time comes, the fallow is cleared by burning—better if the burning is as early as possible after the rains so that the fires are not so fierce as to destroy the valued oil palms or completely to destroy the vitality of the stumps left in the ground.

Southern Nigeria is mainly tsetse infested: cattle are entirely absent over large areas and cultivation is entirely by hand—by the hoe. A family can cultivate two or three acres in this way and produce an adequate supply of the staple food—yams—together with limited quantities of cassava (manioc), corn (maize) and a supply of vegetables in the little garden plot (permanently cultivated) round the hut itself. Thus at any given time the village tract appears to be a series of tiny patches of cultivation in the midst of ragged, untidy second-growth forest of varied age. The patches themselves are a series of mounds or of yam hills (in which the yams or cassava are planted), a few stalks of maize or a few beans or gourds growing in the intervening hollows, and stumps of trees still remaining. Weeds are by no means absent, but the soil is protected. If some of the finer fractions are washed out, they are held up by the neighbouring tract of woodland. If Western ideals of ploughing, extensive clearing, weeding and single cropping were introduced, the soil would immediately be subject to serious erosion from which it is at the moment free. The Agricultural Department in Nigeria has rightly recognized this, and is concentrating its attention on the improvement of the present system by green manuring (by leguminous crops) to replace *part* of the fallow, early burning to prevent serious destruction by fire, and the improvement in quality and yield of the crops grown—especially those which may serve as additional cash crops (citrus, cocoa, oil palm, cotton, kola nuts, etc.) and supply the African with the money he needs for taxes, bicycles, travelling, clothing and the various demands coincident with an increased standard of living.

Northern Nigeria consists of large emirates in which the emir holds the land in trust for his people. The cultivators are his tenants, though often holding the land indirectly through the district headmen. The rainfall ranges from about 25 inches along the northern border to 60 inches in the south, and comes essentially in the wet

Fig. 1.

THE INTRODUCTION OF THE PLOUGH IS LIKELY TO CAUSE EROSION OF THIS TYPE (KANO, NORTHERN NIGERIA). AFTER A HEAVY RAINSTORM, EACH FURROW HAS BECOME AN EROSION CHANNEL CARRYING OFF THE LIGHTER, VALUABLE FRACTION OF THE SOIL.

season from April until October. It falls generally in a succession of storms, four inches in a single night being by no means unusual, and in consequence the predominantly light sandy soils are particularly liable to both sheet and gully erosion. In the dry season the country is parched and bare, and liable, at least in the north, to considerable wind erosion from the dust-laden Harmattan, though the film of fine dust which this wind from the Sahara deposits is not without its value to the soil. The population of the Northern Provinces is irregularly distributed—largely influenced by water supply, with the result that the Geological Survey is at present very actively engaged in well-siting and well-sinking. There is still a sharp distinction between the nomadic, or semi-nomadic cattle-rearing Fulani and the settled Hausa cultivators, though the latter are not blind to the value of manure and may even hire the large white-humped zebu cattle from the Fulani for the sake of their droppings.

The natural vegetation of the Northern Provinces is an open savannah forest with an undergrowth of grass, merging northwards into acacia scrub woodland. Uncontrolled grazing by cattle and the large northern goat results in an uneconomic use of the land, of which there would be ample for normal cultivation on the same basis as in the south. Hence it is, very rightly, the policy of the Agricultural Department to introduce and popularize by means of a series of demonstration farms a system of mixed farming, and to fuse the diverse interests in the land of the Fulani and Hausas. The results are gratifying. In 1928 three farmers tried the experiment; by the end of 1934 the number had increased to 298, but in the next year it had leapt to 621. The staple food crops of the north are the tall guinea corn (with stalks valued for roofing and light fencing), other millets (with a less valuable straw), together with some maize, cassava, and a few yams and, locally, rice. The staple cash crops are ground nuts and cotton. The traditional agricultural implement is the hoe, by which a family cultivates about three acres. The Agricultural Department has introduced a light plough throwing up a ridge on either side and which is to be drawn by the cattle now to be kept penned with millet straw bedding (making a manure with binding qualities on the light soils).

Fig. 2.

THE 'RIDGE AND BASIN' SYSTEM OF NATIVE CULTIVATION IN NIGERIA. THE METHOD IS VERY EFFECTIVE IN PREVENTING SOIL EROSION; THE RAIN WATER ACCUMULATES IN THE BASINS AND SEEPS GRADUALLY AWAY.

The donkeys and goats, so universal in the north, are similarly to be penned and manure prepared in the same way. On this system a family can easily farm twelve acres.

A visit to the experimental farm near Kano, which fortunately took place after nearly four inches of rain had fallen during the night, convinced me that the introduction of the plough into the light land of northern Nigeria is liable to prove a curse which will more than outweigh the blessing conferred by mixed farming. Every furrow is a water course taking off the needed water, every one an incipient erosion gully (Fig. 1). Cross-ploughing at intervals is not a remedy—a new gully is formed—nor is contour ploughing in this gently undulating plain land sufficient.

Fortunately the local cultivator has already evolved a system which points the way. Instead of the yam hills of the south are ridges (from three to six feet apart and from nine inches to thirty inches high) crossed at intervals by ridges at right angles. Instead of the long straight plough-furrow the result is a series of isolated basins. Into these are swept the finer particles of soil during a storm but no soil is lost, for the basins fill with water, which later seeps away. Only rarely does a ridge give way, and even so it is easily repaired. When the land is prepared for the next year's crop the new ridge takes the place of the previous hollow, so that the soil is well mixed again (Fig. 2). The same result can be achieved by ploughing, if the plough is lifted at intervals. This can readily be done with the light plough used. It is clear that the careful use of cover-crops (a dirty farm is probably better than a well-weeded one), the restoration of fertility by leguminous crops, and the maintenance of wind breaks or 'protection forests' (the Forestry Department in conjunction with the French authorities are to preserve the remaining tracts of scrub and woodland along the international border) are all necessary in addition, as well as the control of areas where erosion is already serious.

If America could invent a plough which will imitate the Nigerian system by replacing the long furrow by a series of isolated elongated basins, one at least of her major problems in the dry lands of the Middle West might be solved.

Observations made in the Highest Stratosphere Flight

A DETAILED account has been published* of the scientific results of the flight of *Explorer II*, in which, on November 11, 1935, Major A. W. Stevens and Captain O. A. Anderson ascended to a height of 72,395 feet, or 12·7 miles. This is the greatest height ever reached by man.

To prevent any possibility of a repetition of the disastrous explosion which occurred during the descent of *Explorer I*, it was decided to fill *Explorer II* with helium, even although this meant making the balloon considerably larger. The difficulties of filling these huge balloons are very considerable, and the most suitable place that could be found for carrying out this operation was the "Stratosphere Bowl", a natural crater in South Dakota providing complete shelter from the wind. It was intended to make the ascent in June, but when the balloon was half full the fabric burst round the 'rip-panel'. This panel was to be used for rapid deflation when the balloon landed. As a result of this mishap, the balloon had to be considerably modified and was not ready until October, and suitable weather for the ascent did not occur until November.

A great many people co-operated to make this flight a success. Measurements were made of the angular distribution of cosmic rays, and the nature of the corpuscles forming them, the distribution of ozone, the conductivity and constitution of the air in the stratosphere, and of the intensity of solar and terrestrial radiation. It was proved that the spores of certain moulds and bacteria can and do exist in the stratosphere, and an attempt was made with rather inconclusive results to find whether the great intensity of cosmic radiation would accelerate mutation in *Drosophila*.

Cosmic Rays

The cosmic ray measurements were for the most part carried out under the direction of G. F. Swann. For measuring the angular distribution of cosmic rays a battery of ten cosmic ray telescopes and 210 Geiger counters were used. Five of the telescopes were shielded with lead. The results of this work are illustrated in Fig. 1. In the case of the vertical telescopes, maxima were obtained at the heights corresponding to one and two metres of water below the top of the atmosphere respectively, but these maxima were less pronounced at greater zenith angles. The existence

* "The National Geographic Society—U.S. Army Air Corps Stratosphere Flight of 1935 in the Balloon 'Explorer II'." (Contributed Technical Papers, Stratosphere Series, No. 2.) (Washington: National Geographic Society, 1936.)

of a maximum in the ionization-depth curve shows that it is secondary and not primary particles which do most of the ionizing, and the depth of the maximum gives a measure of the range of these particles. The cause of the second maximum is rather obscure.

It was unfortunately considered impracticable to take cloud chamber photographs of cosmic rays although a special chamber was ready to be taken up. This seems a great pity and in the opinion of the reviewer more useful information would have been obtained by taking up a cloud chamber than a wireless transmitting set. Instead, the balloon carried a number of photographic plates specially prepared with pinacryptol yellow. Such plates

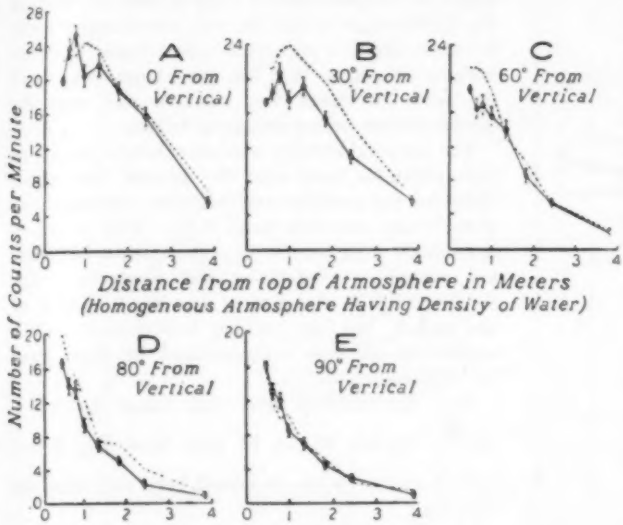

Fig. 1.

IONIZATION-DEPTH CURVES. THE FULL LINES REFER TO SHIELDED, THE DOTTED LINES TO UNSHIELDED, COUNTERS.

serve as continuously acting cloud chambers, in that ionizing particles leave characteristic tracks when the plates are developed; moreover, by counting the grain spacing under a microscope, it is possible to distinguish the track of a proton from that of a heavier particle. The plates were packed in flat nitrogen-filled rubber bags, and some of them were placed almost in contact with compounds of different elements so that the effect of bombardment of these elements by cosmic ray particles could be observed. Locker and Rumbaugh concluded that α-particles form at most a fraction of 1 per cent of the ionizing particles. The neutron intensity at an equivalent of half a metre of water is more than 2,000 times as great as at six metres, and at this height they form a considerable proportion of the ionizing particles although they carry less than 2 per cent of the energy. The rest of the energy must be carried by photons, positrons and electrons, which cannot be detected by this means.

The technique which has been evolved for using photographic plates as continuously acting cloud chambers should prove very valuable and, as there is no need to have a manned balloon to carry the plates into the stratosphere, it is to be hoped that this work will be continued with unmanned balloons.

OZONE

The ozone measurements were made with an ultra-violet spectroscope developed by O'Brian, the amount of ozone between the observer and the sun being deduced from the absorption of the ultra-violet rays. As it was not possible to keep the instrument pointed directly at the sun, sunlight was scattered into the instrument by a diffusing sphere. This also scattered sky light into the instrument, but the effect of this seems to have been neglected. A second instrument was carried to make spectrograms of the sky 9° above the horizon, and with this it was hoped to deduce the distribution of ozone above the balloon, although it is not very clear how O'Brian intended to do this. The second instrument might have been better employed on the ground to measure the changes in the total amount of ozone during the flight.

It is evident from Fig. 2 that the distribution of ozone found by O'Brian on the flights of *Explorer I* and *II* do not agree well with those found by Regener with unmanned balloons, nor with those found by Götz, Meetham and Dobson at Arosa from measurements on the ultra-violet spectrum of the zenith sky at sunset. His distribution agrees more closely with those found by Meetham at Tromsø in latitude 69° 40′ than that at Arosa, which is at about the same latitude, namely, 40°. There was little ozone near the ground or below 15 km., and the maximum concentration was at 22 km., almost exactly the height reached by the balloon. The other workers found much larger concentrations near the ground.

CONDUCTIVITY

Knowledge of the electrical conductivity of the atmosphere in fine weather is of great importance as it enables us to find the potential of the Heaviside layer. If we assume that the vertical air-earth

current is constant and equal to i units per sq. cm., then if λ is the total conductivity (equal to the sum $\lambda_+ + \lambda_-$), the potential is $i\int_0^H \frac{dz}{\lambda}$.

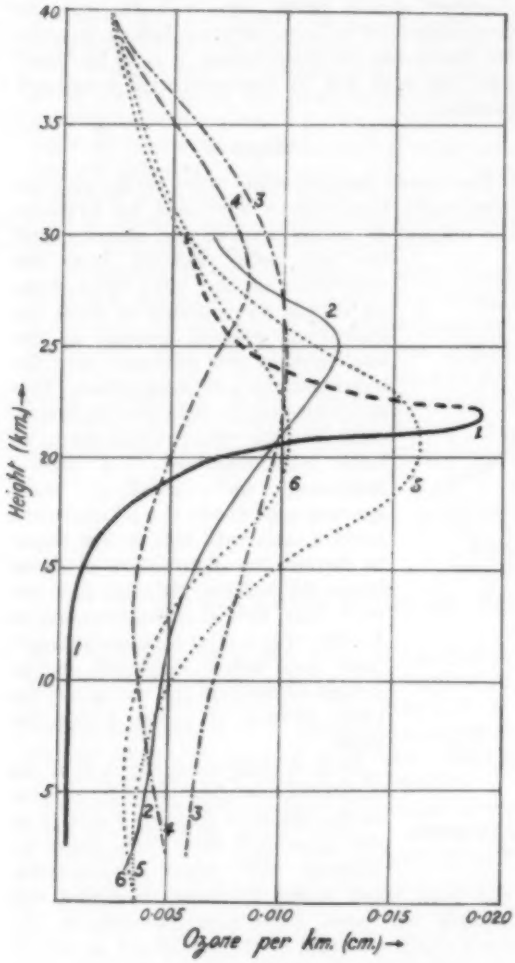

Fig. 2.

OZONE PER KILOMETRE AS A FUNCTION OF ALTITUDE.

CURVE 1. FLIGHT OF *Explorer II*. TOTAL OZONE. $x = 0{\cdot}19$ CM. DOTTED PART DERIVED FROM SKY OBSERVATIONS.

CURVE 2. REGENER'S SOUNDING BALLOON. $x = 0{\cdot}28$ CM.

CURVES 3 AND 4. GROUND DETERMINATIONS BY GÖTZ, MEETHAM AND DOBSON AT AROSA. CURVE 3: $x = 0{\cdot}20$ CM. CURVE 4: $x = 0{\cdot}30$ CM.

CURVES 5 AND 6: GROUND DETERMINATIONS BY MEETHAM AT TROMSØ. CURVE 5: $x = 0{\cdot}30$ CM. CURVE 6: $x = 0{\cdot}22$ CM.

Regener and others have measured the ionizing power of cosmic rays at different heights at the same latitude as Dakota; making certain assumptions and neglecting the effect of nuclei of condensation, the positive conductivity should be

$$\lambda_+ = 9{\cdot}8 \times 10^{-4} \frac{T^{5/3}}{p} I^{\frac{1}{2}}.$$

It is of great interest to compare this value with a direct determination.

Gish and Sherman constructed a rather ingenious modification of Gerdien's apparatus for measuring the conductivity. It consisted of a charged insulated rod in a cylindrical condenser through which air was aspirated. When the rod had lost a certain charge and therefore reached a critical potential, it was automatically recharged and a mark was made on a spiral record. By means of switches the potential to which the rod was charged could be made positive or negative and could be given various values, so that the same apparatus could be used for measuring positive and negative conductivities at several sensitivities.

The air conductivity was enormously greater at high altitudes than near the ground, but at all altitudes the positive and negative conductivities were in the constant ratio 0·78. This is not in agreement with laboratory experiments, but these are probably vitiated by free electrons. The conductivity on the descent was less than that on the ascent, but the authors believe that on the ascent the air was contaminated by gases from the balloon.

The conductivity was not equal to $9{\cdot}8 \times 10^{-4}\frac{T^{5/3}}{p} I^{\frac{1}{2}}$, but it can be seen from Fig. 3 that from 3 km. to 18 km. it agreed very well with the formula

$$\lambda_+ = 9{\cdot}8 \times 10^{-4} \frac{T^{5/3}}{p} I^{\frac{1}{2}} \cdot \left(\frac{p}{p_0}\right)^{0{\cdot}35}$$

where p_0 is the pressure on the ground.

Below 3 km. divergence from this value was to be expected because of the presence of nuclei of condensation. The authors suggest that the discrepancy above 18 km. was either due to the fact that the air was not drawn sufficiently fast through the Gerdien condenser, or to the presence of more nuclei. Some support to the latter hypothesis is provided by the fact that a new air mass was encountered at about this height. That there can be nuclei of condensation in the stratosphere is proved by the occasional occurrence of mother of pearl clouds at 18–30 km.

It is very much to be hoped that this work will be followed by further experiments with unmanned balloons. In any event Gish and Sherman are to be congratulated on a very valuable piece of work. They deduce a potential for the Heaviside layer of about 400,000 volts.

AIR COMPOSITION

In the troposphere, the air is being constantly mixed, and has almost perfectly uniform composition except with regard to water vapour and carbon dioxide. The great stability of air in the stratosphere to be expected from the absence of temperature gradient led people to expect that in this region each gas would behave independently of the others, so that there should be an increasing preponderance of light gases at great heights, for example, hydrogen and helium. However, the behaviour of balloons in the stratosphere has shown the existence of considerable winds giving rise to mixing; the extent to which this mixing is complete is of considerable interest to the geophysicist.

Various methods have been devised by which samples can be taken with unmanned balloons, and in England a good deal of work of this nature has been done by Paneth and Dines; with small sounding balloons, however, it is difficult to get large enough samples for very accurate analyses. *Explorer II* carried up three flasks, all of which were exposed at about 21·5 km., just at the beginning of the descent. The third of these had a very ingenious valve for admitting air, but unfortunately this failed owing to the presence of a drop of oil in a capillary tube.

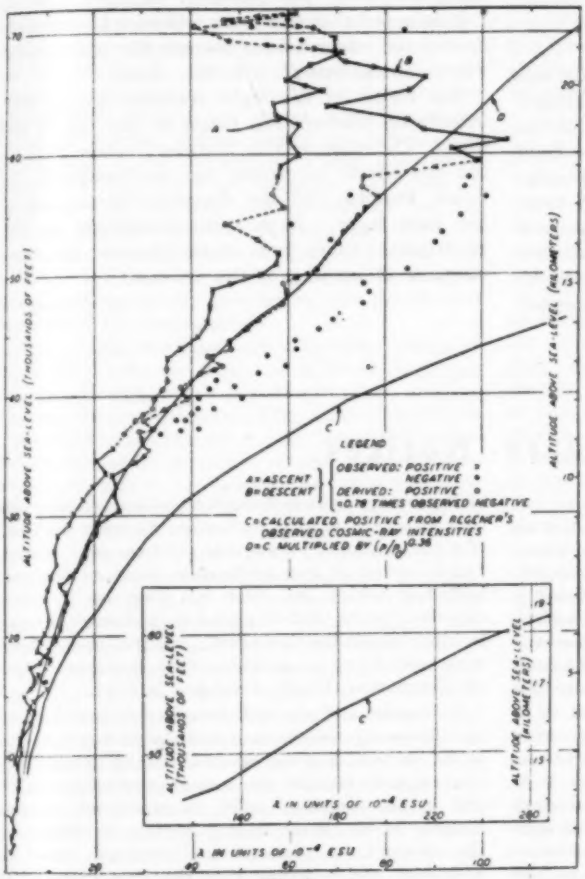

Fig. 3.

AIR CONDUCTIVITY, FLIGHT OF *Explorer II* NEAR RAPID CITY, SOUTH DAKOTA, NOVEMBER 11, 1935.

Paneth has shown that helium provides the best criterion of mixing, since the amount of hydrogen is everywhere negligible, and helium is the next lightest gas. The two samples were analysed for helium, oxygen and carbon dioxide, the former by measuring the residue when the other gases were absorbed in charcoal. The amount of helium was about fifty times what was to be expected, but this only shows that the air was contaminated by helium from the balloon.

Oxygen was determined both by absorption in potassium pyrogallate and by combustion with hydrogen. The two methods agreed well, and the final results were:

Carbon dioxide	$0{\cdot}029 \pm 0{\cdot}002$
Oxygen	$20{\cdot}895 \pm 0{\cdot}003$

At ground-level the proportion of oxygen is 20·945 per cent. The authors are uncertain whether the difference can be regarded as representative or whether under the peculiar weather conditions of the flight the air which they sampled was not brought down from even greater heights.

MICRO-ORGANISMS

Rogers and Meier performed experiments to determine whether there are any spores present in the stratosphere. It is well known that these can withstand great extremes of cold; their presence in the stratosphere would throw much light on the spread of micro-organisms, and would also demonstrate the mixing between stratosphere and troposphere air.

A special spore-collecting apparatus was devised which was dropped from the stratostat at 71,000 feet. It was carried down by a parachute which would open some time after leaving the balloon. As soon as the parachute opened the collector was exposed. It was afterwards closed by syphon bellows at 36,000 ft., which is just about the height of the base of the stratosphere.

Every precaution was taken to avoid contamination, and on incubation on agar jelly at 30° C. five colonies of bacteria and five moulds developed. The bacteria were all different and afterwards withstood temperatures much lower than those encountered on the stratosphere flight. The moulds were identified as *Rhizopus*, *Aspergillus niger*, *Aspergillus fumigatus*, *Penicillium cyclopium* and *Macrosporium tenuis*, all of which have frequently been collected on aeroplane flights.

CONCLUSION

A considerable amount of very useful data was obtained on this flight, and one has great admiration for the intrepid aeronauts who navigated the balloon, and the ground staff who made the flight possible. Nevertheless, one is inclined to wonder whether, from a purely scientific point of view, the money would not have been better spent in sending up a large number of unmanned balloons. Practically all the apparatus was entirely automatic in operation and it was merely necessary for the crew to press a few switches. It might be rather difficult to operate the cosmic ray apparatus and ozone spectrographs in an unmanned balloon, but Regener has succeeded in doing this. The total weight to be carried up was enormously increased, both by the passengers themselves and by the air-tight stratostat with its air-conditioning apparatus. On the other hand, the popular appeal was far greater, which doubtless made it much easier to collect the necessary funds.

It is hoped that this flight will soon be repeated, as isolated observations become far more useful when substantiated by further data.

The report of the flight contains several very interesting photographs taken at the top of the flight. The most striking features in these pictures are the effects of erosion on the topography of South Dakota, and the sharpness of the top of the haze layer. Even more interesting are the photographs taken from an aeroplane at the exact moment of landing of the balloon.

R. T. P. W.

Obituary Notices

Sir James Crichton-Browne, F.R.S.

SIR JAMES CRICHTON-BROWNE, who died on January 31 at the age of ninety-seven years, was born at Dumfries in 1840. His father was Dr. W.A.F. Browne, who became Commissioner on Lunacy for Scotland, and was at the time of his son's birth head of a famous private asylum in Dumfries—the Crichton Royal Institution. Crichton-Browne as a boy saw his father applying new methods to the treatment of the insane; they were treated as if they were rational human beings—they were employed according to their bent in the day-time, entertained in the evening and surrounded with the comforts of a home. His father believed in education—particularly of the young medical men who were to devote their lives to the care and treatment of insanity. It was in the late fifties of last century, when Crichton-Browne was a medical student in the University of Edinburgh, that Prof. Laycock of that University began to give lectures on the disordered psychology of the insane. In no other university or medical school in Great Britain was any attempt made to give systematic lectures on insanity. It was otherwise on the Continent.

It cannot, therefore, be a matter of surprise to find young Crichton-Browne, when he became a qualified medical man in 1861—he being then twenty-one years of age—resolving to do for the insane of England what his father had done for their unfortunate brethren in Scotland. In the year in which he qualified, he gave a paper to the Royal Medical Society of London on "The Clinical Teaching of Psychology". It is difficult to believe, as one reads that lecture now, that its mature thoughts are those of a young man of twenty-one. "There are," said he, "in the midst of your civilization, currents swift and relentless which are ever hurrying on countless contributions to that whirlpool in the vortex of which so many minds float wrecked". The full and rounded style with which he enlightened his listeners in those later days was already developed in 1861.

Newcastle-on-Tyne had discernment, and snapped up this young medical Scot and placed him in charge of its asylum, and the medical school of that city made him its lecturer on medical psychology. While still in his twenties (1866), he was made medical director of the West Riding Asylum at Wakefield. He brought enlightened and humane methods with him, and believing that the foundation of all progress in medicine depends on research, had a laboratory built and equipped in connexion with the asylum. A glance at the reports which were issued under his direction will show how well he planned. The most famous of all the researches done there was that which laid the fame of the late Sir David Ferrier (1843–1928). In the spring of 1873, Ferrier visited the West Riding Asylum, Ferrier being then thirty years of age. Crichton-Browne was his senior by three years, they had been at the University of Edinburgh together. A discussion sprang up on the experiments which Fritsch and Hitzig had done on the brains of dogs. The result was that Ferrier stayed on to repeat similar experiments and ultimately proceeded to apply faradic stimulation to the cortex

of the brains of monkeys. These experiments laid the basis of our knowledge of localization of function in the cortex of the human brain. The incident is worthy of notice, for it illustrates the manner in which Crichton-Browne helped in the growth of scientific knowledge. There was no jealousy in his composition; he welcomed knowledge from any source, so long as it was real knowledge.

In 1875, Crichton-Browne left Wakefield to become a Lord Chancellor's visitor in lunacy. It was thus early that he became a feature of London social life: no gathering of medical or of scientific men seemed complete without him; he had a rare zest for public life. He was elected to the Royal Society in 1883, and at the time of his death he was senior fellow. In 1880, he became a member of the Royal Institution. James Dewar was then in the fourth year of his directorate; both men were steeped in the Edinburgh tradition. In 1889 he took over the honorary treasurership of the Institution, and held that office and all that it embraces until 1926. He was elected to the Athenæum Club in 1893. He took an active part in all medical societies which concern themselves with the life and disorders of the human brain.

It was during the later part of his treasurership at the Royal Institution that the writer of this note had the privilege of his friendship. One incident may be mentioned because of the light it throws on Crichton-Browne's character. Sir James Dewar was not always an easy colleague and was at times dictatorial—almost outrageously so. It so happened that towards the end of the Great War, Prof. H. H. Turner of Oxford was busy in the theatre of the Institution making ready for his Christmas lectures for children. Dewar entered to find Turner grouping a class of young children to represent the heavenly bodies and their movements. "What is this?" demanded Dewar. Turner explained. Dewar banned the scheme out of hand. Turner banged the lecture-room door and refused to return—on the eve of Christmas. It was then that Sir James Crichton-Browne appeared on the scene and in two days had peace restored and lectures assured. It was all accomplished by clear thinking, honest speaking and the pertinacity of a good heart. He combined in his person and in his mentality traits of both the centuries in which he had lived. He dressed his beard and his hair to the last in the fashion which prevailed when he was a young man in the late 'fifties; his oratory was of the kind beloved by the Gladstonians, but his attitude towards affairs was always modern.

Crichton-Browne loved his native town—Dumfries and all connected with it—especially Burns and Carlyle. His pen never wearied in their defence. Next to Dumfries came Edinburgh and its great men—especially Walter Scott. His interests were so diverse and so wide. Among his writers, Shakespeare stood highest, Scott next. His pen was always busy—always in search of his country's good. It is not necessary here to give a list of the non-professional books he wrote—from "The Nemesis of Froude" (1903) until the last of his reminiscences, which began to appear after his official retirement in 1922. The first volume of this series, "Victorian Jottings", appeared in 1926; the fifth, "The Doctors After-Thoughts", in 1932. Up to the last he and Lady Crichton-Browne went every year—spring and autumn—to breathe his native air at Crindau, Dumfries. It was during a visit to Crindau that death came to him. His brother, Balfour Browne, was the most successful parliamentary barrister of his time. Crichton-Browne himself had the makings of a great judge. Indeed he was a very great Victorian, the last of them. He was great not because of any contribution he himself made to medicine or science, but because he fostered the conditions which ensure the birth of knowledge in others. He was great both for what he did and for what he was. A. K.

Sir Thomas Stanton, K.C.M.G.

THE sudden death on January 25, at the age of sixty-two years, of Sir Thomas Stanton has come as a great shock to his many friends, both at home and abroad. Although Stanton, as director of Government Laboratories, Federated Malay States, and later, as chief medical adviser to the Colonial Office, occupied prominent positions throughout a large part of his life, he never sought publicity, and the public never fully appreciated the work which he had done on beriberi, on malaria and other diseases, or his work at the Colonial Office in reorganizing the Colonial Medical Service.

Stanton went to Malaya in 1907 and was soon engaged in the work with which, perhaps more than any other, his name will be permanently associated—the discovery of the cause of beriberi and of means for its prevention. At the beginning of this century, beriberi was certainly a medical puzzle. Its neuritis and paralysis were so similar to alcoholic and lead poisoning that few people doubted that beriberi was the result of the entry into the body of some poison. The late Dr. W. L. Braddon strongly maintained the hypothesis that the poison entered the system in white polished rice, and that it was absent from par-boiled and partly polished rice. But evidence that rice was not a factor seemed so conclusive from experiments conducted by the late Dr. E. A. O. Travers in two jails at Kuala Lumpur that in Manson's "Tropical Diseases", third edition (1903), it is stated: "This view has been disposed of effectively by experiments by Dr. Travers. This experiment was prolonged and scrupulously carried out." Braddon was not convinced, and a polemic ensued, as a result of which Dr. William Fletcher carried out an experiment in his hospital wards at Kuala Lumpur at the suggestion of his chief, Dr. Travers.

The question was far from being one of merely academic interest. There were hundreds of new cases of beriberi every year in Malaya. The tin mines suffered severely. Sometimes the disease attacked the jails so seriously that a sentence of six months' imprisonment threatened to be a sentence of death, or what might perhaps be regarded as worse, a life sentence of paralysis following beriberi. Fletcher set out to confirm Travers's view that rice played no part in causing beriberi. At the end of

the experiment, he was convinced that rice was the cause of the disease. The next question was, How did the rice produce beriberi? It was at this point that Stanton and Fraser of the Institute for Medical Research entered on their work, which not only showed exactly how rice produced beriberi but also what rice produced beriberi and what rice did not produce the disease. They showed further that the disease was not, as Braddon maintained, caused by a poison in the rice, but was a deficiency disease caused by the removal of the pericarp in the polishing of the rice; and they proved that if a fowl were suffering from beriberi as a result of being fed on a polished rice, it could be rapidly cured by giving it the polishings. They found that unpolished rice never produced beriberi in fowls, and with the introduction of unpolished rice into the jails the disease rapidly disappeared. For a time it looked as if the amount of phosphorus pentoxide (P_2O_5) in rice could be taken as an indicator of the danger of beriberi developing, but further observations showed that this test could not be relied on.

The discovery was of great value in itself, and of vast economic importance to Malaya; so much so that had it stood alone it would have justified all the money that had been spent on the Institute for Medical Research from its foundation. But it had a still greater significance, for it suggested lines of research into other diseases, which in their turn proved to be deficiency diseases. To-day vitamins are a household word, and the accessory foodstuffs are studied in probably every country in the world. There can be few Governments which are not inquiring into and trying to improve the food of their nationals on the lines of the discovery made by Stanton and Fraser.

Space will not allow me to say much more on Stanton's work in Malaya. From 1911 until 1926 we were colleagues on the Malaria Advisory Board in the Federated Malay States, and Stanton's interest in this subject was shown not only by his valuable contributions to the discussions of the Board, but also by his researches into the morphology of the anopheline larvæ, which were of material assistance to the practical work of mosquito control and the prevention of malaria in Malaya.

May I conclude with a personal remark. No one could come into contact with Stanton without realizing that behind a quiet demeanour lay an active brain, carefully balancing the pros and cons of everything he discussed. What was perhaps not less important, he was a man who could be trusted; a scientific investigator of distinction and a great gentleman. MALCOLM WATSON.

Dr. W. W. Vaughan

NEWS of the death on February 4 of Dr. W. W. Vaughan, as the result of an accident, will be received with deep regret by his many friends in scientific circles. A note in last week's issue of NATURE, p. 236, described the circumstances of the unfortunate fall, while visiting the Taj Mahal at Agra, which resulted in his death. When we went to press, it was reported by cable that his condition after the amputation of his leg was favourable, and it was hoped that he would make satisfactory progress toward the recovery of his normal good health. Those, however, who saw the serious nature of the accident at the time of its occurrence, when Dr. Vaughan had to lie in the open with a compound fracture for more than an hour before an ambulance could be found to move him to the Thomason Hospital, scarcely expected that he could recover, and their fears have been sadly confirmed by the fatal result.

Dr. Vaughan was one of the few headmasters of public schools who had been presidents of the Educational Science Section of the British Association; and he was distinguished among all of them who have occupied this office in the continued part he played in the work of the Association. It was while visiting India as a member of the delegation of the Association to the jubilee meeting of the Indian Science Congress Association that he met with the accident which has led to his death.

Dr. Vaughan was born in 1865 and was the son of Prof. H. H. Vaughan, regius professor of modern history in the University of Oxford. He was educated at Rugby School, New College, Oxford, and the University of Paris; and his main subjects were modern languages. In 1890 he became an assistant master at Clifton College, where he remained until 1904, when he was headmaster of Giggleswick School. From 1910 until 1921 he was master of Wellington College, and he then returned as headmaster to his old school, Rugby, where he remained until his retirement in 1931. He was president of the Modern Language Association in 1915, of the Incorporated Association of Headmasters in 1916, of the Science Masters' Association in 1919, and of the Education Section of the British Association in 1925. He served on the Consultative Committee of the Board of Education and on the Government committee appointed in 1916 under the chairmanship of Sir J. J. Thomson, on the position of natural science in the educational system of Great Britain. At the time of his death he was a member of the Council of the British Association and of the Advisory Committee on Education in the Colonies.

When Dr. Vaughan was president of the Science Masters' Association he dealt, in his presidential address, with the importance of science as part of a liberal education. He urged that the aim of scientific instruction should not be purely utilitarian but that of education as a whole—the liberation of man's soul. He referred to these objects again in his address to the Educational Science Section of the British Association. "We seem almost to have lost the will," he said, "to keep by education the pores of the soul and the mind ever open to the impressions of experience, to the stirrings of emotion, to the slow and enduring influence of the reason. We have too often pinned our faith on the production of dexterity, of mental facility, of almost thoughtless accuracy, and we have our reward in our educational looms being ill-adapted to the production of contentment and beauty and the power or the will to reason."

It was because Dr. Vaughan cherished these high educational ideals that his influence while a school master and since his retirement is appreciated by all who have come under it. By his lamented death, the educational interests of science have suffered a severe loss and his many scientific friends have to mourn the passing into silence of a helpful colleague.

We regret to announce the following deaths:

Prof. H. H. Donaldson, for thirty-two years professor of neurology in the Wistar Institute of Anatomy and Biology, Philadelphia, known for his work on growth, particularly of the nervous system, on January 23, aged eighty years.

Mr. Alan E. Munby, architect of Clifton College Science School and other important science laboratories, on January 19, aged sixty-eight years.

Dr. Andrei Vassilievitch Martynov, professor in the Institute of Palæontology at Moscow, well known for his work on Trichoptera and fossil insects, on January 29, aged fifty-nine years.

Dr. F. G. Pease, of Mount Wilson Observatory, where he was responsible for the design of many large instruments, on February 7, aged fifty-seven years.

Prof. Herman Schlundt, chairman of the Department of Chemistry of the University of Missouri, known for his work on radioactivity, on December 30, aged sixty-eight years.

News and Views

The London School of Economics

In a leading article on "Realistic Social Studies" in NATURE of January 22, incidental reference was made to the London School of Economics and it was stated "that responsible bodies which administer funds for research . . . have refused to renew temporary grants such as the Rockefeller subsidy to the London School". We are informed that the facts with regard to the Rockefeller Foundation are as follows: "During the past three years, four temporary grants from the Foundation to the School have been in force. Two of these for the purpose of site extension and library development still remain available; a third, providing funds for research, terminated in 1935 and was then renewed on a somewhat different basis for a five-year period; the fourth grant, providing facilities for post-graduate teaching and research, does not expire until the end of the current academic year. No formal application has yet been made by the School for the renewal of this grant: hence, no action has yet been taken. If the editorial of January 22 seems to imply that there has been any criticism offered or expressed by 'responsible bodies which administer funds for research' such an implication does not exist. In point of fact, no criticism as to the teaching and research in economics under way at the London School has ever been made on the part of any Foundations which have assisted it in the past and assist it now." The context of our comment made it clear that it referred to the grant which terminated in 1935, and that it had no relevance to any allocations for the purchase of books, for site extension or for post-graduate instruction. We were in receipt of full information concerning the "somewhat different basis" on which the grant was renewed. If, as we understand, the previous annual grant which terminated in 1935 was replaced by a reduced and tapering allocation, there seems little ground for objection to the statement published in our editorial. The main purpose of the article was to urge that the new Institute of Economic and Social Research should "tackle the fundamental problems arising from the way in which expanding technical resources react upon, and are used by, existing social institutions"; and the purpose will have been served if the article leads to the extension of social research in these directions. With Prof. Carr-Saunders as the new director of the School it may confidently be expected that increased encouragement will be given to such studies.

American Institute Awards

Dr. W. Crocker has been awarded the Gold Medal of the American Institute of the City of New York for "his contribution to knowledge of life processes in plants and for his unique leadership in the organization of plant research". Dr. Crocker was professor and director of research in plant physiology at the University of Chicago for many years. He organized and has directed the Boyce Thompson Institute for Plant Research from the time it was founded in 1921 to the present day. At the University of Chicago and the Boyce Thompson Institute for Plant Research he has acquired a reputation as an organizer and director of research. His method has been to bring together specialists in different fields of knowledge and to give these specialists an opportunity to work co-operatively on biological problems that have not yielded to attacks by individuals working single-handed. Dr. Crocker has also done noteworthy research. He was the first to show that ethylene gas in air in amounts far too small to be detected by any known chemical means causes profound reactions in plants. He

proved that ethylene 'puts plants to sleep'. He has shown how certain seeds that remain dormant for many years may be induced to grow if given proper treatments. Low temperatures, chemicals, light and other environmental agencies have been used to break these long rest periods. His work on the physiology of dormancy in seeds has contributed to fundamental knowledge of life processes. The Gold Medal of the American Institute may be awarded either to organizations or to individuals.

WALDEMAR KAEMPFFERT, science editor of the *New York Times*, and Dr. Raymond L. Ditmars, curator of reptiles and mammals of the New York Zoological Park, have been awarded fellowships of the American Institute for their contributions to science. Mr. Waldemar Kaempffert was awarded the fellowship "for his scholarly interpretation of scientific advances, for his editorial wisdom, for his adroit cultivation of the public mind toward a rational outlook and for his leadership in enforcing their social responsibilities upon scientists". Mr. Kaempffert, who is president of the National Association of Science Writers, has for many years been a leader in the promotion and maintenance of the high standards of science reporting in the United States. He took up his duties as science editor of the *New York Times* in 1927, leaving in 1928 to become the first director of the Museum of Science and Industry in Chicago. He is responsible for the real establishment of that great institution for the interpretation of science to the public. Mr. Kaempffert returned to the *New York Times* in 1931, where his weekly columns on the latest developments of science have become a source of invaluable information to thousands of readers not only on the facts of science but also on its philosophy.

DR. RAYMOND L. DITMARS has received the American Institute fellowship "for his thirty-seven years of distinguished service in the care, understanding and interpretation of the reptile world and for his inspiring of youthful spirits with the zeal of the naturalist". Dr. Ditmars is the author of many fascinating volumes on his work with snakes, including "The Making of a Scientist", "The Thrills of a Naturalist's Quest", "Snakes of the World" and "The Forest of Adventure", which latter presents his subject especially for boys and girls. At his laboratory in the New York Zoological Park, Dr. Ditmars is engaged in biochemical research on the subject of snake poisons as a useful substance for the treatment of certain human ailments, including hæmophilia, the reduction of pain, and epilepsy. In announcing these fellowships, Dr. Gerald Wendt, director of the American Institute, explained that they were awarded each year by the Institute to "persons who have done outstanding work in the interpretation of scientific, engineering or industrial work, which promotes with effectiveness the knowledge and general understanding of these arts and sciences. The recognition of these interpreters of science is an important element in the Institute's programme, which has as its primary purpose the integration of scientific advances with the social structure."

The Soviet North Polar Station

DURING the last two months, the Soviet observatory placed on a floe near the North Pole in May 1937 has been drifting rapidly southward in the East Greenland current. Fortunately for the safety of Papanin and his three companions, the drift cleared the north-east corner of Greenland and the floe appears to have kept to the outside of the stream of ice down the coast. On February 3, the station was reported to be in lat. 74° 8′ N., long. 16° 24′ W., which was within about eighty miles of the Norwegian observatory of Myggbukten at the mouth of Franz Josef Fjord in East Greenland. It is reported that although this station is not functioning, it shelters a wintering party of four men provided with dog teams. To try to reach the shore, however, over the drifting and grinding pack would be difficult and hazardous. The floe on which the Soviet party is living has split; the men have lost some of their equipment and are now on a small floe, but they have their tents, instruments, three months' stores and sledges.

RELIEF for the expedition is being hurried forward, but will be impeded by the winter darkness and the difficulty of finding an adequate landing place for aeroplanes. *The Times* reports that the small wooden survey vessel *Murmanets* is near Jan Mayen, a distance of less than two hundred miles, and that the Arctic ship *Taimyr* has left Murmansk with aeroplanes and dog teams. Cinematograph equipment is being taken by the *Taimyr* and it is hoped to film the voyage of the vessel, the North Polar station, the removal of Papanin and his companions from the ice-floe and their return home. As the work will have to be done in the darkness of the Polar night, portable lighting equipment to be operated by current from the *Taimyr* is being taken. In the event of the vessel being unable to approach close enough to the ice-floe, a small portable generator and magnesium flares will be used. The *Taimyr* has been delayed by heavy weather and the more powerful *Murman* sailed from Murmansk on February 6. The icebreaker *Yermak*, with aeroplanes, was to leave Leningrad on February 8, but has a long journey ahead of her. Aeroplanes are also leaving Green Harbour, Spitsbergen. Prof. O. Schmidt is directing the relief operations. Papanin's message that wireless communication may be interrupted but that there is no immediate danger expresses the daring of these adventurous men. The Norwegian and Danish authorities have offered to assist in the rescue work.

Colour Television at the Dominion Theatre, London

ON February 4, a surprise item was introduced into the regular programme of the Dominion Picture Theatre, London. At 8 p.m. an experimental demonstration of Baird colour television was effected for

the first time in public. The sending station was the South Tower of the Crystal Palace, the wave-length employed being 8·3 metres. The quality of the pictures was naturally much inferior to those with which the present-day viewer is familiar: only 120 scanning lines being used as compared with the 400 lines now employed by the British Broadcasting Corporation. The projected picture was twelve feet by nine feet and could be clearly seen by everyone in this large theatre. It was illuminated by a high-intensity arc lamp. The programme included the transmission of fashion plates of ladies hats; the various coloured flowers were quite brilliant and the gaily and variegated headgear sometimes used by officers abroad came out very distinctly. A coloured cartoon of Popeye the Sailor caused much amusement. Colour television is still in the early stages of development, but the transmission was very successful and the unexpected show was well received by the spectators.

THE present apparatus used by Baird Television transmits a 120-line picture, the scanning at both transmitter and receiver being by mechanical means. The transmitter consists of a mirror drum with twenty mirrors inclined at different angles revolving at 6,000 r.p.m. These mirrors reflect the scene to be transmitted through a lens, causing an image to be formed on a rotating disk with twelve concentric slots at different distances from its periphery. By this means the field given by the 20-line drum is interlaced six times to give a 120-line picture repeated twice for each revolution of the disk. Each of the slots is covered with a light filter, blue-green and red being used alternately, the effect of this being to transmit alternate lines of the picture corresponding to a blue-green image and a red image. At the receiving station a similar device is employed, the rotating drum in this case being much larger (12 in. in diameter in place of the 8 in. at the transmitter). Light from a high intensity arc lamp is concentrated on the moving aperture in the disk and yields sufficient light to fill a screen 12 ft. × 9 ft.

Archæological Expedition to Syria

SIR LEONARD AND LADY WOOLLEY, it is announced, are leaving England for Syria, where the British Museum Expedition under Sir Leonard's direction will resume excavations immediately at Tell Atchana in the Amk plain on the Orontes, North Syria. This site, as has been shown by the previous seasons' excavations, has surpassed anticipation in its importance for the cultural relations of Asia and the eastern Mediterranean at an early date. The results which have been obtained already, as has recently been demonstrated by Sir Arthur Evans, when correlated with the information now accruing from the excavations of French archæologists at the Syrian site of Ras Shamra, have already thrown light on chronological and other problems of the Minoan civilization of Crete, as well as indicated the extent of Cretan influence on Asianic culture. The work of the British Museum Expedition in the coming season will be devoted mainly to the further exploration and clearing of the palace, of which, as was pointed out by Sir Leonard Woolley in his recent lecture before the Royal Institution (see NATURE, January 29, p. 194), the architecture both in material and in style is as essentially Cretan as the painted pottery discovered on this site. It is hoped that additions to knowledge of political and social conditions of the time may accrue from further discoveries of the cuneiform tablets, from which it has already been established that the building is a royal palace dating to about 1600 B.C. Sir Leonard Woolley will be accompanied by Mr. P. W. Murray-Threipland, who will again act as his assistant, and by Mr. Ralph Lavers, acting as architect of the expedition, who has had previous experience of archæological investigation at Tell el-Amarna in Egypt and in Crete.

Dynamic Ecology of Sand Dunes

AT the Friday evening discourse at the Royal Institution on February 4, Prof. E. J. Salisbury discussed "Plants of the Sand Dunes and Why They Grow There". Sand dunes are a unique type of habitat. They depend on plants for their development. They show such rapid changes that the dynamic character of communities of plants is here forced upon our notice. Moreover, because a sequence in space corresponds to the sequence of development in time, the nature of these changes can be ascertained with certainty. The pioneer plants are rapidly growing grasses equipped with leaves which are so constructed that they automatically adjust their rate of water loss to the water income. Further, these grasses can endure burial by sand and are indeed stimulated thereby to grow through to the new surface. All these features enable them to endure the desert-like conditions and mobility of their rooting medium. Although the water content of young dunes is less than four per cent, it is maintained at a comparatively constant though low level owing to the occurrence in sunny weather of conditions that promote internal deposition of dew within the dunes. Sand dunes thus illustrate in a striking manner the dynamic character of vegetation and the fallacy of the widespread belief that to preserve a natural area all that is necessary is to leave it alone.

Dublin Zoo and Bird Sanctuary

AT the annual meeting of the Royal Zoological Society of Ireland, held at Dublin on January 26, Lord HolmPatrick was re-elected president, Dr. J. Agar Matson honorary secretary, Mr. Cecil Pim honorary treasurer. It was announced that Dr. B. B. Farrer, superintendent and secretary of Dublin Zoo for the past twenty-six years, is retiring. Dr. Matson reported that during the year 1937 there was an increased attendance at the Zoo of 152,173 visitors as against 151,109 in 1936, receipts having increased from £3,561 to £3,661. Membership increased by 54. The Government's grant of £1,000 was continued and various improvements and works are being carried out, the new bear enclosure now

nearing completion. More than £520 was spent purchasing and transporting animals like penguins, sea-lion, wolves, wallabies and laughing jackass; but owing to various restrictions some valuable animals offered could not be accepted. The meeting was followed by a lecture by Father P. J. Kennedy, a well-known local ornithologist, on the birds of Phœnix Park. Father Kennedy gave a detailed history of the formation of the Park until it was turned into a bird sanctuary in 1937, its trees, shrubs, lakes and ponds being so valuable. The birds he then discussed were the 83 species which have been observed in the Park, and included grey crow, rook, jackdaw, magpie, jay, starling, greenfinch, goldfinch (which he said is increasing), chaffinch, bullfinch, linnet, crossbill, yellow-hammer, skylark, pied wagtail, tree-creeper, black-cap and spotted fly-catcher.

The Maidenhair Tree

THE origin of the curious generic name, *Ginkgo biloba*, of this tree is very fully discussed, with reference to original Chinese and Japanese descriptions, by Prof. A. C. Moule in *T'Oung Pao*, 23, published by the firm of E. J. Brill, Leyden. The name seems to be due to Engelbert Kaempfer, a German naturalist (1651–1716) who was in Japan apparently about 1690–2. The Kaempfer MSS. are stated by Larousse to be preserved in the Museum of Botany at Leyden where, however, search has failed to find them; Prof. Moule, however, through Sir Albert Seward, has traced the original entries of Kaempfer in his manuscripts in the British Museum. These seem to make it clear that when Kaempfer, some eighteen years later, published the names from his original descriptions, he deciphered incorrectly an original manuscript entry of Sankyo in the form of *Ginkgo*, where it is difficult to decide whether the 'g' is a slip in transcription or a misprint that has been overlooked. Thus "this strange word, which is unpronounceable and probably ought never to have existed, has been for nearly two centuries and, I suppose, will always be the generic name of this beautiful and interesting tree". There is a very full discussion of the numerous Chinese names of this tree which are all either descriptive names of two or more words or are frankly borrowed from other trees, suggesting that the tree was not known in northern China during the centuries when the Chinese classical civilization and language were being formed. This may confirm the view of F. N. Meyer and others that the tree is indigenous in the forests of Chê-Chiang, but in favour of the other view that it survives only in cultivation is the fact that no large specimens have been reported from forests. There is an interesting discussion of its fire-resisting qualities, which were exemplified by the recovery of many trees in Tokyo after the big fire that followed the earthquake in 1923; popular testimony thus made a huge *Ginkgo* tree largely responsible for the survival of the great temple of Kwannon at Asakasa; it was believed that the tree literally rained moisture on the roof, and also protected it against burning fragments carried in the wind.

Health Committee of the League of Nations

AT the twenty-fifth session of the Health Committee of the League of Nations, April 26–May 1 (G. Allen and Unwin, League of Nations Department, 40 Museum St., London, W.C.1: Report to the Council on the Work of the 25th Session of the Health Committee, 1s.) the next three-year programme was discussed and approved. Among the permanent activities of the Committee, its work on biological standards is far from being completed. New therapeutic agents gain acceptance with the advance of science and require assay in terms of some common standard, and other standards already adopted are either open to improvement or, being composite, are liable to be replaced sooner or later by the active substance in pure form, apart from the possibility of physical or chemical methods replacing the biological method. Forty-one countries have adopted or are about to adopt the international standards recommended by the Permanent Commission on Biological Standards, and thirty-one Governments have established or are about to establish national centres, thus simplifying the task of the central institutes at Copenhagen and Hampstead. For drugs like digitalis, pituitary extract and arsphenamine, no insuperable difficulties are anticipated in preparing national standards, but it is expected that for serological standards the Copenhagen Institute will have to continue to supply international standard sera to most of the national centres. The standardization of anti-anthrax serum, examined in 1925, requires further investigation in collaboration with the Institute at Budapest and Bucharest. Further study of the standardization of anti-swine-erysipelas serum is also necessary as well as consideration of changes in the international standards for tuberculin and staphylococcus anti-toxin. The standardization of anti-snake venom sera, pharmacological standards, as well as those for vitamins and sex hormones, also fall within the next three-year programme of the Commission. Other matters in the programme of the Committee are leprosy, rural hygiene, housing, physical education, nutrition and opium and other dangerous drugs.

Dietetics and Social Problems

THE problem to what extent a wise social policy, taking into account modern scientific developments in the field of nutrition, can help to raise the standard of living in certain countries, or for certain categories of population, which at present suffer from undernourishment or malnutrition, is being investigated by the International Labour Office, assisted by a Committee of Experts which met at Geneva on April 9–10, under the chairmanship of Mr. Bramsnaes. This committee discussed the efforts of the International Labour Office to demonstrate the progress of dietetic science and its importance in regard to social questions. Special stress was laid on the necessity of distinguishing between the physiological, health and social aspects of the problem, and it was agreed that the studies should be studied simultaneously in various countries according to a uniform

plan which would assist international co-ordination of comparative results. The projected investigations are aimed at determining the relation between nutritional requirements and different occupations, the economic and social effects of different policies of improving the standard of nutrition of workers and their families, and at defining the principles on which the regulation of wages, where it exists, is based and methods of fixing benefits under social insurance or assistance schemes. Other studies will deal with the nutrition of apprentices and young persons and of the unemployed, etc.

Rural Electrification

At the present time many people are interested in the supply of electricity for thinly populated districts, but they are only beginning to realize that it is a very safe commercial venture. There is a great demand for an electric supply at a reasonable cost and the expense of advertising by demonstration vans, etc., is not great. In a paper on this subject read by J. S. Pickles to the Institution of Electrical Engineers on December 2 it is pointed out that in many countries abroad the public supply of electricity is regarded as a necessity. As a practical example of what can be done by borough councils, he gives a description of the Dumfries scheme, which covers the whole of a geographical county of 1,070 square miles in area. With the exception of only one town, no electrical development had previously taken place in the supply area. The scheme was begun six years ago, the electric supply being purchased by the borough from the Central Electricity Board. The policy adopted aimed at providing supply to every consumer without asking him to make a contribution towards the capital cost, no matter what was the length of his necessary service main. Neither was he asked to pay any guaranteed minimum revenue. The adopted scheme provided for the immediate erection of a comprehensive system of overhead wires with the necessary transformers, etc., capable of giving a supply practically to all prospective consumers within the area. It was recognized that the expenditure of large capital sums in the early years would lead to commercial deficits unless the development amongst consumers was very rapid.

There is an assisted wiring scheme extending over five years for the consumer and no initial payments of any kind are required. A two-part tariff is usually adopted. The consumer pays ¾*d*. per unit for running costs and 5 shillings per room per quarter, no charge being made for sculleries, bath rooms, box-rooms, etc., and 20 is the maximum number of rooms for which a charge is made. A radiator can be hired for 1*s*. 6*d*. per quarter and a wash boiler for 2*s*. 6*d*. A two-part tariff meter has been adopted, which collects both the fixed and the running charges. Very few of the consumers go for long holidays, and so the supply is never cut off for long periods. As many of the consumers have 'all-mains' wireless sets they never allow their supply to be cut off for long. During the first five years of working the scheme there have been small deficits in the year's working, but it is estimated that from the sixth year onwards there will be a profit. Doubtless later on there will be a reduction in the consumer's charges, as the demand seems constantly increasing.

The *Modern Quarterly*

We welcome the first number of the *Modern Quarterly* (offices: 2 Parton Street, London, W.C.1), because throughout it proclaims the supreme importance and the social function of science in the contemporary world. But we must add a qualifying regret that it appears both from its contents and the personnel of its editorial council to be inclined to identify the progress of science with one form of the organization of society and especially of industry. This must prejudice many readers against the suggestive ideas and generally high aims of the promotors. Must we accept Marx, Lenin and Russia, it will be asked, as the gospel and best exemplification of science in society? Are not the more liberal, though more slowly moving societies, like our own, perhaps doing the work of human evolution even more effectively in the long run, certainly without the bitterness and the bloodshed of the revolutionary method? But these are large questions impossible to discuss in a note. Of the articles in this number, two should be especially mentioned: the first, by Prof. H. Levy, acutely criticizing the mechanistic explanation of the universe, and the fourth, by Dr. Joseph Needham (the bulk of his Herbert Spencer Lecture at Oxford), in which he attempts a revaluation of Spencer's presentation of the idea of progress. This is the most valuable part of this first number and deserves careful study, none the less because it contains conspicuous examples of the communistic doctrines referred to above. Mr. Max Black has an article carefully considering and criticizing the doctrines of Wittgenstein and the logical Positivists. It is rather a remarkable feat to be able to write a complete, though short, account of "The Evolution of Positivism" (including the nineteenth century) without even mentioning the man who first systematized that way of thinking and gave it its name.

Earthquake in the East Indies

One of the greatest earthquakes for several months past occurred on February 1. The first movements were recorded at Kew at 7 h. 19 m. 52 s., p.m., and the largest oscillation about three-quarters of an hour later. According to Mr. J. J. Shaw, it was a very deep-seated earthquake. The records at Kew and Bombay show that the distances of the origin from these two places are respectively 8,250 and 4,250 miles. Thus, the earthquake occurred in the Banda Sea in about lat. 5° S., long. 130° E., at 7·5 p.m., G.M.T. (February 2, 1.45 a.m., local time). Three earthquakes, with a focal depth of about 260 miles, occurred close to the spot indicated (in lat. 5·5° S., 130° E.) on May 10, 1920, and March 23 and 24, 1921; while two others, with the same focal depth, originated in a centre lying five degrees to the east on October 10, 1921, and February 19, 1923.

Both foci lie close to the great arc of Sumatra, Java, Sumbawa, Flores, etc., along which many other earthquake centres, deep-seated and otherwise, are clustered.

Association for Physical Medicine

THIS society was inaugurated on January 27 at 56 Russell Street, W.C.1, with Dr. P. Dalton in the chair. The aims of the Society are: (1) To co-ordinate the various branches of physical medicine under one control; (2) to co-operate with manufacturers in the production of suitable appliances for medical and surgical use, and to prevent their sale to unsuitable persons; (3) to secure a national register of those practising the science and to affiliate all appropriate bodies; (4) to institute a chair of physical medicine in one or more of the universities and to establish a post-graduate school; (5) to establish contact with the general practitioner and to keep him informed of the changes in the subject; (6) to establish a technical board to act in an advisory capacity.

Announcements

ON February 12, two men of science of international reputation celebrate their birthdays. Prof. W. B. Scott, emeritus professor of palæontology in Princeton University, is eighty years of age; and Prof. Otto Pettersson, the Swedish chemist and oceanographer, is ninety years on that date. They may be assured that they have the congratulations and best wishes of scientific workers everywhere.

THE fifteenth Duddell Medal of the Physical Society has been awarded to Prof. H. Geiger, professor of physics in the University of Tübingen.

THE triennial award of the Coopers Hill War Memorial Prize and Medal, which fell in 1937 to the Institution of Electrical Engineers, has been made to Dr. T. E. Allibone for his paper on "The Mechanism of the Long Spark".

THE Council of the Institution of Civil Engineers has made the first award of the James Alfred Ewing Medal to Mr. Charles Samuel Franklin. This medal was founded in 1936 in memory of Sir Alfred Ewing, and is awarded, irrespective of membership of the Institution, for specially meritorious contributions to the science of engineering in the field of research.

PROF. W. P. JORISSEN, of the University of Leyden, will deliver a lecture entitled "Reactions in Gaseous and Solid Mixtures", in the Chemistry Lecture Theatre of the Imperial College of Science and Technology, on February 21, at 5.15 p.m. Admission to the lecture is free.

FIVE lectures on science and industry have been arranged by the Association of Scientific Workers, to be given in the Chemistry Theatre, University College, London. The lectures are as follows: February 16, Sir Richard Gregory on "Science and Industry"; February 24, Sir John Russell on "The Application of Science to Food Production"; March 2, Major F. A. Freeth on "Science and the Chemical Industry"; March 9, Dr. E. A. Rudge on "Training for Industry"; March 17, Dr. F. S. Sinnatt on "The Fuel Research Survey". The lectures will be given at 8.15 p.m. Tickets are obtainable from the Secretary, Association of Scientific Workers, 28 Hogarth Road, London, S.W.5, free to members and 1*s.* 6*d.* to non-members for the series, or 6*d.* for a single lecture.

AT the annual general meeting of the National Institute of Sciences of India, held on January 8, the following were elected officers: *President*, Prof. M. N. Saha; *Vice-Presidents*, Prof. S. S. Bhatnagar and Brevet-Colonel R. N. Chopra; *Treasurer*, Dr. B. S. Guha; *Foreign Secretary*, Prof. B. Sahni; *Secretaries*, Prof. S. P. Agharkar and Dr. A. M. Heron.

THE Medical Research Council has been entrusted with an annuity of £350 for a period of twenty-five years, provided by the late Mr. Eugen M. Schlesinger and by Mrs. Schlesinger to establish a memorial to their daughter in the form of a Kathleen Schlesinger Research Fellowship. This is to be given for investigations on the subject of cysts of the brain or allied conditions, and will ordinarily be tenable at the National Hospital for Diseases of the Nervous System, Queen Square, London, for periods of from one to three years. Awards will be made by the Council with the assistance of a special advisory committee appointed in terms of the trust deed.

DR. EUGEN FISCHER, professor of anthropology in the University of Berlin, and Dr. Hermann Lautensach, professor of geography at Greifswald, have been nominated for honorary doctorates of the University of Coimbra.

THE annual congress of the German Society of Balneology and Climatology will be held at Kiel on February 24–27. Further information can be obtained from Dr. Pfleiderer, Tirpitzstrasse 12, Kiel.

THE fortieth Congress of the German Zoological Society will be held at Giessen on July 4–6, 1938. Further information can be obtained from the Secretary of the Society, Invalidenstrasse 43, Berlin, N.4.

DR. G. D. BHALERAO, helminthologist of the Imperial Veterinary Research Institute, Muktesar-Kumain, India, is to prepare a volume in the "Fauna of British India" on Trematoda.

IN the article entitled "Museum Study of Man and his Work" in NATURE of December 25 (p. 1108), reference is made to the Colonial Institute at Haarlem. This is incorrect; the Colonial Institute is at Amsterdam.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 291.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Direct Photography of Ultracentrifuge Sedimentation Curves

SEVERAL good methods now exist for observing the sedimentation boundary in the ultracentrifuge. That described here should, however, be useful because it is the least laborious way of producing a 'sedimentation diagram' (that is, a curve relating concentration gradient to distance from the axis of rotation). It is probably not so accurate as the 'scale' method[1], though this question seems worth investigating; but certainly the accuracy is sufficient for a great many purposes.

The method is based on the *Schlieren* principle as adapted to the ultracentrifuge by Tiselius *et al.*[2]. Added to this is a modified form of Thovert's principle[3] involving a diagonal edge and a cylindrical lens. The limitation which makes Thovert's own arrangement unsuited to the ultracentrifuge (cf. Lamm[1]) has been circumvented in that the optical path through the centrifuge cell can be made as narrow as desired without restricting the width of the photograph.

The optical path is shown in Fig. 1. Conjugate foci are marked a, a', a'' or b, b', b''. A is the light-source, B a condensing lens which focuses a large image of A on the centrifuge cell E. C is a rectangular stop, the upper edge of which is smooth and straight. It is focused by the spherical lenses D and F on a similar stop G, which is inclined at an angle to C. H is a cylindrical lens with vertical axis. Seen in plan, it focuses G on the photographic plate I. In elevation H has no effect, but F focuses E on I.

From A to G the arrangement is identical with an ordinary *Schlieren* arrangement, except that G happens to be farther from F than is usual. At G the diagonal edge causes light which is deviated upwards to be obstructed at one side but not at the other, and the cutting-off point is shifted sideways proportionately to the upward deviation. The cylindrical lens H focuses the sideways shift on the plate while the cell is still focused vertically. The dividing line between light and darkness therefore takes the form of the required sedimentation diagram since the upward deviation at G (and therefore the sideways shift at I) is proportional to the gradient of refractive index and concentration. If θ is the angle at any particular height in the cell made by the edge G with the vertical, the sideways shift caused by unit concentration gradient varies as $\tan\theta$. Hence the sensitivity may be varied between zero and infinity by rotating the edge.

The compression in the cell introduces a linear term in the gradient of refractive index, which is equivalent to the introduction of a horizontal cylindrical lens. This may be compensated by introducing a cylindrical lens of opposite sign at D, but in practice it is sufficient to move the stop C or the spherical lens D along the optical axis. There is also some irregular curvature due to bulging of the quartz plates in the cell, which cannot be compensated automatically and must be allowed for if high sensitivities are used.

Introduction of another vertical cylindrical lens between E and F improves the illumination, but is not essential.

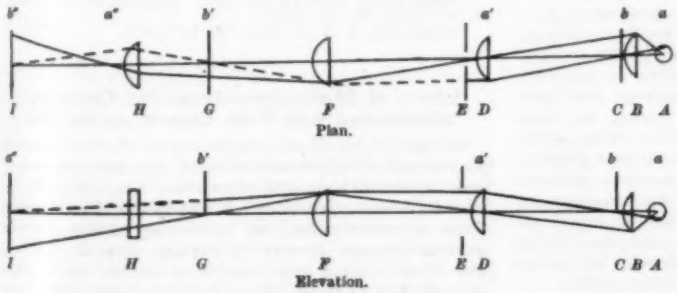

Fig. 1.

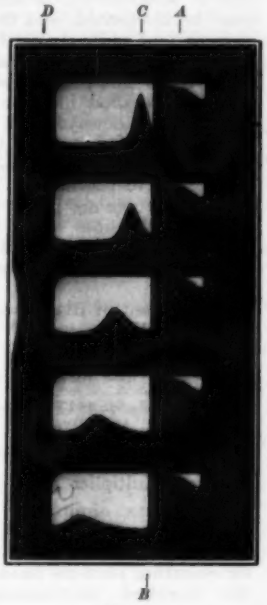

Fig. 2.

SEDIMENTATION OF LYSOZYME. *A*, PARAFFIN; *B*, MENISCUS; *C*, SEDIMENTATION BOUNDARY; *D*, INDEX'. FORCE, 300,000 TIMES GRAVITY; EXPOSURE INTERVAL, HALF AN HOUR; CONCENTRATION, 0·6 PER CENT; CELL THICKNESS, 6 MM. SPECIMEN PROVIDED BY DR. E. R. H. ROBERTS.

Fig. 2 shows photographs of the sedimentation of lysozyme ($s = 2 \times 10^{-13}$) taken by this method. The edge of the curve is not quite sharp. Simple theory, verified by experiment, shows that the sharpness increases with increasing brightness of the source or time of exposure, and decreases with increasing sensitivity. The source used at present is a Pointolite, without colour-filter, and there is slight chromatic aberration due to dispersion by the protein and to residual error in the corrected lenses D and E. For these

reasons it is preferable to use intense monochromatic light, from a filtered high-pressure mercury arc.

In interpreting the photographs it is sufficient for many purposes to note the general shape of the curves and to measure the positions of the maxima to the nearest 50 μ with a rough comparator. For the highest accuracy the sideways shift is best measured with a photo-electric comparator and plotted out after subtracting the base-line obtained from a control run. This is as laborious as the scale method and is seldom worth while. If the concentration of sedimenting protein is required, the curves must be integrated, and the particular arrangement of black and white should be ideally suited to photo-electric integration. This has not yet been attempted.

No exact comparison of accuracy with that of the scale method has yet been made. It is easy to obtain a sideways shift twenty times as great as the upward one given by the most sensitive setting of the scale method, and to measure it photo-electrically to the nearest 20 μ with high reproducibility, but there are many possible systematic errors analogous to those which have been studied in the scale method (Lamm[1]) and of which a similar study will have to be undertaken.

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Department of Biochemistry,
University,
Oxford.

[1] Lamm, O., *Nova Acta Regiæ Societatis Scientiarum Upsaliensis*, Ser. IV, **10**, No. 6.
[2] Tiselius, Pederson and Eriksson-Quensel, NATURE, **139**, 546 (1937).
[3] Thovert, J., *Ann. Phys.*, (9) **2**, 369 (1914).

Electron-Multiplier as an Electron-Counting Device

MY efforts aiming at improving the electron-counting devices already known and extending their range in the visible part of the spectrum when used for counting photons have led to the application of the so-called electron-multiplier, based on the secondary emission principle. Recent experiments which I have carried out have shown its usefulness in the detection of individual electrons. The application of the method described here is easy and gives reliable and reproducible data.

An electron-multiplier tube with cæsium electrodes has some inherent disturbing effects that hinder the direct application of this tube as a counting device. Among them are the thermal emission of the cæsium surfaces and the leakage current.

The thermal emission, calculated according to Richardson's law, is 10^{10} electrons/cm.²/sec. at room temperature, taking $\varphi = 0{\cdot}75$ volt for the work function and $A = 9{\cdot}8 \times 10^{-3}$ amp./cm.² degr.² for the first Richardson constant. (The electrons emitted by the first electrode give rise to a multiplication in n stages, the electrons of the ith electrode to that in the $n-i+1$ stages and these together create a basic current in the collector corresponding to the zero illumination. For example, this current has been found in one case to be 17×10^{-6} amp. at room temperature, in accordance with the value given above.) This current determines the lowest limit of the sensitivity of the multiplier and seems to prevent the use of the multiplier as an electron-counting device. It is easy to see that cooling in liquid air practically annihilates the thermal emission. Using the same data as above, Richardson's law gives immediately the number of electrons/cm.²/sec. :

$n = 0{\cdot}35$ at 150° K. and $n = 6{\cdot}7 \times 10^{-10}$ at 120° K.

Another disturbing factor, the leakage current, has been eliminated by suitable spacing of the lead-in wire of the collector and that of the other electrodes, and by enclosing the whole tube in a vessel containing dry nitrogen. The insulation was found to be greater than 10^{13} ohms.

With regard to the output capacity and the multiplication factor of the multiplier tube, and the input capacity of the amplifier used, the voltage amplitude at the first stage of the amplifier has been calculated to be 50 μv., a value which exceeds the natural noises of the amplifier (the thermal agitation and the shot-effect) by one order of magnitude. Experiments have proved the expected result and by observation of the output voltage (on the screen of a cathode ray tube) it has been possible to count the individual electrons.

Low-speed electrons generated in vacuum can be counted by the method described here *by vacuum processes* only. It is the first counting method of its kind.

Compared to the counting devices already known using the production of ions in a gas-filled space, our method has the advantage of extremely good resolving power, which is in principle limited only by the transit time of the electrons in the multiplier tube. The counting gives always reproducible data.

As a first and simple application of the new device, I used it for counting photons, and it proved to be very successful. The zero illumination effect was found to be 40 electrons/minute, a number which can be further reduced by suitable improvement of the working conditions. Corresponding experiments are in preparation.

Our experiments having proved that the cooling process did not alter the light sensitivity and multiplication factor of the multiplier tube, we are justified in applying the data to the light sensitivity and photo-electrical output of the cæsium photo-cell obtained by previous workers at room temperature. The counting rate[1] is 2 per cent in the red maximum. Thanks to the excellent quality of the cæsium, this value is better than those obtained by other photon-counting methods[2].

Naturally the method of electron-counting presented here is not restricted to the use of liquid air. It is possible to get similar results by the application of a multiplier tube that has emitting surfaces made of a material having an appropriate high work function, and which accordingly has a low thermal emission.

A detailed communication is in preparation.

Z. BAY.

Tungsram Research Laboratories,
United Incandescent Lamps
and Electrical Company,
Ujpest, nr. Budapest.
Dec. 18.

[1] Kluge, *Z. tech. Phys.*, **18**, 185 (1935). Kreuchen, P. A., *Z. Phys.*, **94**, 549 (1935); **97**, 625 (1935).
[2] Kiepenheuer, K. O., *Z. Phys.*, **107**, 145 (1937).

Effects of Methylcholanthrene and Colchicine administered with Plant Extracts on the Rat

IN the course of investigations on the response of plants and of 'phytocarcinomata' to various carcinogenic hydrocarbons and other compounds having the phenanthrene nucleus[1,2,3], it was found that some of these substances had an inhibitory action on the general somatic growth of certain plants. It was also found that it was possible to restore the normal growth-rate of these plants by simultaneous administration of certain plant extracts.

Haddow, C. M. Scott and J. D. Scott[4] have demonstrated that certain carcinogenic hydrocarbons and other chemically related substances had a persistent or temporary inhibitory influence on the body-growth of the rat, when administered by intraperitoneal injection.

We tested the above-mentioned combined treatment of plants on animals by the following methods.

Two series of experiments were made, one in early summer and one in late autumn. We used albino rats (150 in all) weighing 50–60 gm. The animals were divided into different groups and treated as follows: one group was given intraperitoneal injections of 10 mgm. of methylcholanthrene dissolved in 2 c.c. sesame oil; the second group was given intraperitoneal injections of 0·03 mgm. of colchicine dissolved in 2 c.c. sesame oil. Other groups were given, simultaneously with the intraperitoneal injections of methylcholanthrene or colchicine, subcutaneous injections of 1 c.c. lettuce or mistletoe extracts[5]. Control groups were given corresponding quantities of either sesame oil alone by intraperitoneal injection, or one or the other of the two plant extracts alone, by subcutaneous injection. Finally, one group was left without any treatment.

Table 1 shows the principal results of the summer and winter experiments. It may be added, however, that while the results of the summer and autumn experiments agreed as regards the body-growth of animals treated with methylcholanthrene alone, there was a discrepancy in the effects of the simultaneous treatment with methylcholanthrene and the above-mentioned plant extracts; the inhibitory influence of the combined treatment being about the same in summer as that of methylcholanthrene alone, while in autumn the percentage increase of the body weight of the animals subjected to the combined treatment was about four times as great as that obtained in animals treated with methylcholanthrene alone.

TABLE 1.

Treatment	No. of animals	Average mortality rate (days)	Percentage increase in body-weight in 21 days	% weight of testis in relation to body-weight	Ascorbic acid content of liver per (mgm./100 gm.)
Oil	23	Until the end of the experiments (60 days)	51·34	1·37	13·740
Methyl-cholanthrene	23	21	15·17	0·97	8·535
Colchicine	8	Until the end of the experiments (34 days)	36·62	1·76	11·291
Control	23	Until the end of the experiments (60 days)	48·64	1·50	11·472

TABLE 2.

PERCENTAGE OF ANIMALS WITH FAT DEPOSITS.

Numerals 0 to 5 indicate the degree of fat deposits: 0 = none, 5 = maximum.

Treatment	0	1	2	3	4	5
Oil	100	—	—	—	—	—
Methylcholanthrene	6·6	—	6·6	26·8	20	40
,, + lettuce	46·8	20	6·6	6·6	20	—
,, + mistletoe	74·6	14·2	—	14·2	—	—
Control	100	—	—	—	—	—

The most striking effect of methylcholanthrene was, however, the deposit of fat formed on the surface of the different organs of the abdominal cavity. In extreme cases, these coatings of hard fat attained a thickness of 3–4 mm. Table 2 shows, moreover, that the formation of these fat deposits could be considerably reduced by simultaneous subcutaneous injections of the plant extracts.

Animals treated with colchicine did not show fat deposits at all.

Preliminary observations have further shown an increased rate of cell division in the animals treated by us with methylcholanthrene alone, as revealed by Prof. A. P. Dustin after an injection of colchicine. It seems that methylcholanthrene sensitizes a great number of cells to the action of colchicine, such as the histiocytes and certain parenchymatous cells (amongst others those of the thyroid and salivary glands).

Summing up the various observations made in the course of the present preliminary experiments, it appears that profound metabolic and probably hormonal changes are involved in the carcinogenic action of methylcholanthrene, long before any morphological signs of tumour growth can be detected.

LÁSZLÓ HAVAS.
EMERY GAL.

Institute of Pathological Anatomy,
University, Brussels.
Biological Research Institute,
Tihany, Hungary.
Dec. 19.

[1] Havas, L., NATURE, **139**, 371 (Feb. 27, 1937).
[2] Havas, L., NATURE, **140**, 191 (July 31, 1937).
[3] Havas, L., *Bull. Ass. f. Cancer*, Dec. 1937 (in the Press).
[4] Haddow, A., Scott, C. M., and Scott, J. D., *Proc. Roy. Soc.*, B, **122**, 477 (1937).
[5] Havas, L., C.R. Congrès int. Cancer, Bruxelles (Sept. 1936).
[6] Dustin, A. P., Havas and Lits, Congrès des Anat. (Marseille, 1937).
[7] Chodkovski, K., *Protoplasma*, **28**, 597 (1937) (literature).

Autonomous Rhythmical Activity of Sense Organs

LIKE the lateral-line organs of fishes and the receptors of the semicircular canals of the dogfish[1], the nerves supplying the ampullæ of Lorenzini in elasmobranch fishes exhibit a spontaneous discharge of impulses. The receptors of the lateral line can be excited to a higher frequency of discharge by a flow of fluid in the canal[2], and although there is no evidence that such a flow can actually occur except when artificially produced, the possibility cannot be entirely ruled out that some unidentified mechanical agency external to the receptor is responsible for the maintenance of a permanent state of excitation. Hoagland[3], indeed, has argued that the spontaneous activity of lateral-line organs is due to a ciliary activity of the hair cells. It is therefore especially significant that a capsule containing a group of ampullæ of Lorenzini, with the nerve supplying it, can be isolated

from a pithed ray, and can continue to discharge impulses spontaneously for more than 24 hours.

The capsule, no larger than a match head, contains no muscular tissue, and there are no hair cells in the receptors[4]. The capsule with its nerve was completely freed from its surrounding tissue and mounted in a moist chamber with the nerve resting on a pair of electrodes leading to an amplifier and oscillograph. The nerve was cut down so as to leave only a few intact fibres. A record taken soon after the preparation was installed shows three impulse trains at frequencies 5, 8 and 9 a second. A record taken the next day, 24 hours later, shows the same three fibres discharging at 9, 9 and 10 a second. The preparation was not disturbed between the taking of the two records; indeed, the moist chamber was not opened, and the temperature remained at 12–13° C. The preparation ceased to function 36 ± 6 hours after it was removed from the fish.

Even if hair processes were present as some earlier histologists have maintained, it is scarcely possible that they should beat at a rate of 10 a second in so viscous a medium as the jelly contained in the ampullary canals.

This observation rigidly fulfils the conditions for the demonstration of an independent physiological rhythm and there can be little doubt, therefore, that the spontaneous discharge represents an autonomous rhythm of excitations within the receptor cells.

A. SAND.

Marine Biological Association
of the United Kingdom,
The Laboratory,
Citadel Hill,
Plymouth. Jan. 7.

[1] Löwenstein, O., and Sand, A., *J. Exp. Biol.*, **13**, 416 (1936).
[2] Sand, A., *Proc. Roy. Soc.*, B, **123**, 472 (1937).
[3] Hoagland, H., "Pacemakers in Relation to Behaviour" (New York, 1935).
[4] Dotterweich, H., *Zool. Jahrb.*, **50**, 347 (1932).

Secretory Elements of the Pars Nervosa of the Pituitary

UNTIL recently it had been widely held that the nervosa hormones pitocin and pitressin, or their antecedents, were elaborated by the pars intermedia and were, from there, transferred to the nervous lobe. However, De Lawder, Tarr, and Geiling[1] have demonstrated the presence of these hormones in the pars nervosa of the fowl's pituitary, where there is no possibility of contamination of nervosa tissue with that of a pars intermedia. Hence the hormones must be formed by the endogenous constituents of the nervosa.

Bucy and Ibanez[2] have demonstrated the presence of characteristic glial cells, nerve fibres and terminals in mammalian partes nervosæ. Bucy termed the glial cells pituicytes, and naturally suspicion has fallen on these as the secretors of the hormones[3]. I have demonstrated the presence of pituicytes in all classes of the vertebrates (a full report of this work has been submitted to the Linnean Society of New South Wales for publication). If the pituicytes are secretory, it is to be expected that the hormones would be present in the various groups of vertebrates. This is so[4]; pitocin, pitressin and pituicytes occur in Tetrapods and Teleostei, while in Elasmobranchs pituicytes and pitocin occur. Pitressin may be present, but in the small doses used to date, it has not been detected.

Cowdry[5] considers it possible that the nerve fibre terminals may be secretory. The tissue culture work of Geiling and Lewis[6], however, shows that pitressin, at least, cannot be secreted by these agents. They made cultures of mouse pars nervosa, and in doing so, inevitably separated each nerve fibre from its perikaryon in the supra-optic nucleus; thus Wallerian degeneration would occur. Pitressin was conclusively demonstrated fifty days after explantation, and the only characteristic elements present were "extensive networks of large cells resembling neuroglia cells". These were undoubtedly the glial pituicytes, so it may be said that very probably the pitressin was elaborated by these cells. No test was made for pitocin, but since the nucleus supra-opticus is sympathetic in character[7] and all the evidence points to the fact that the secretory activity of the nerve terminals of the autonomic system is confined to the production of acetylcholine or an adrenalin-like body[8], it does not seem likely that pitocin is secreted by nerve terminals, which suggests that it also is secreted by pituicytes.

MERVYN GRIFFITHS.

Department of Zoology,
University of Sydney.
Dec. 2.

[1] De Lawder, Tarr, and Geiling, *J. Pharmacol.*, **51**, 142 (1934).
[2] Bucy, *J. Comp. Neurol.*, **55**, 505 (1930). Ibanez, *Trav. Lab. Rech. Biol. Univ. Madrid*, **29**, 235 (1935).
[3] Geiling, *J. Amer. Med. Assoc.*, **104**, 738 (1935).
[4] Herring, *Q. J. Exp. Physiol.*, **6**, 73 (1913). Hogben and de Beer, *Q. J. Exp. Physiol.*, **15**, 163 (1925).
[5] Cowdry, "A Text Book of Histology", p. 205 (London: Henry Kimpton, 1934).
[6] Geiling and Lewis, *Amer. J. Physiol.*, **113**, 534 (1935).
[7] Crouch and Elliott, *Amer. J. Physiol.*, **115**, 245 (1936).
[8] Loewi, *Proc. Roy. Soc.*, B, **113**, 299 (1935). Cannon and Rosenblueth, "Autonomic Neuro-Effector Systems" (Exp. Biol. Monographs, Macmillan, N.Y., 1937).

Adrenal Cortex Differences in Male and Female Mice

THE letter from Miss Deanesly published in NATURE of January 8, and dealing with the adrenal of the mouse, contains several inaccuracies. I feel bound to correct one which is not open to argument. Miss Deanesly gives what purports to be a brief account of the relevant literature. She has omitted to include a paper published six months ago by Dr. E. S. Horning and myself[1], which records observations having an important bearing on the subject under discussion. This paper contains a section entitled "The So-called X-zone and its Significance", to which readers of NATURE interested in the subject are referred. The warning given therein, that the adrenals of mice of inbred strains may show abnormalities and should, therefore, not be used for the interpretation of histological changes in the adrenal of normal mice, has unfortunately not been heeded by Miss Deanesly. The paper also points out the inadequacy of the histological methods used by other workers, including Miss Deanesly, in the study of the adrenal gland of the mouse.

W. CRAMER.

Imperial Cancer Research Fund,
London. Jan. 11.

[1] Cramer, W., and Horning, E. S., *J. Path. and Bact.*, **44**, 633 (1937).

DR. CRAMER alleges "several inaccuracies" in my letter, but the only "inaccuracy" specified, is the failure to cite a paper by himself and Dr. Horning

dealing with pathological conditions in the adrenals. It was obviously impossible to give a full bibliography of the subject, and reference was made to the more recent paper (Cramer and Horning, *Lancet*, June 1937). The main facts regarding the sex difference in the mouse adrenal are well established, and various histological techniques have been successfully used by different workers. No good purpose would be served by controversy on the subject in these columns. The size of the *X*-zone in the female may vary in different mice, but its presence is certainly independent of inbreeding or pathological conditions. The dwarf mice referred to in my letter are born from phenotypically normal parents carrying a recessive Mendelian factor, and their production is not dependent on inbreeding. Their interest lies in the congenital pituitary deficiency, to which one may reasonably ascribe the absence of the usual response of the adrenal cortex to castration.

RUTH DEANESLY.
National Institute for Medical Research,
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Jan. 28.

Optimum Temperature of Formation of a Blood Clot

In the course of experiments designed for the practical purpose of finding the most suitable conditions for the assay of hæmostatic surgical dressings containing thrombin, we have encountered a blood-clotting phenomenon which is apparently new. Not all the thrombin present can readily be extracted from these dressings, so that a new method has to be used for the estimation, depending on the measurement of the amount of clot produced on the fabric by soaking in an excess of citrated blood under specified conditions, the whole specimen being subjected to micro-Kjeldahl nitrogen estimation after removing the unclotted blood by washing. The quantity of clot is measured in milligrams of nitrogen per sq. cm. of fabric.

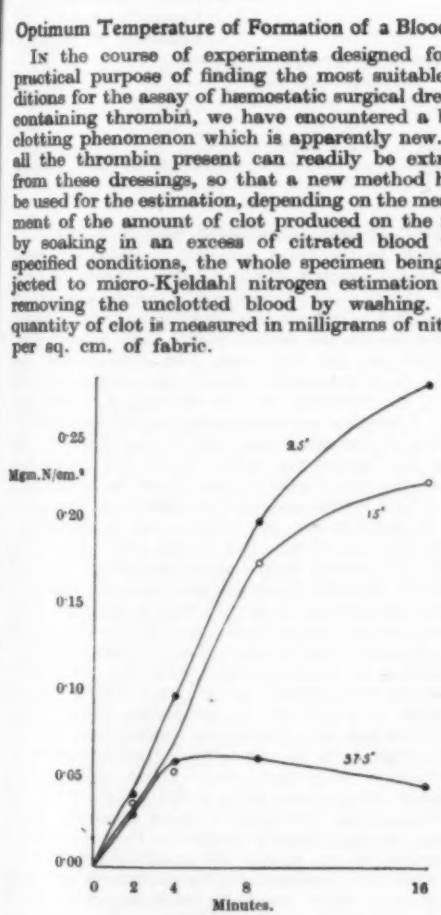

Fig. 1.

THE RELATION OF TIME TO AMOUNT OF CLOT AT THREE TEMPERATURES. POINTS ARE MEANS OF FIVE TRIALS.

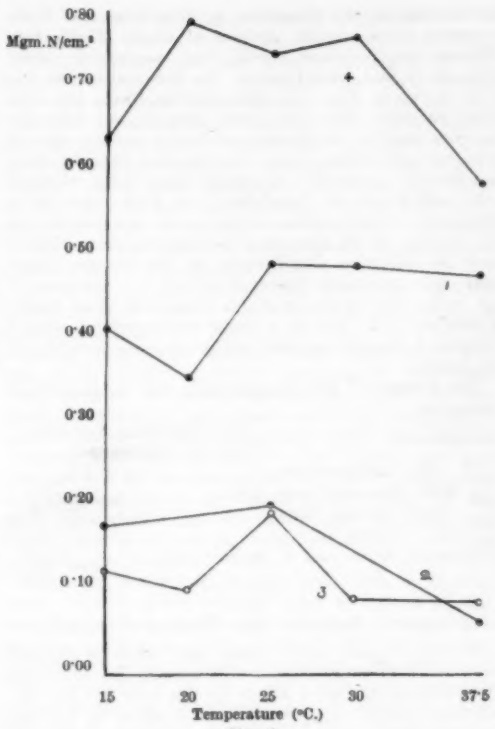

Fig. 2.

THE RELATION OF TEMPERATURE TO AMOUNT OF CLOT. ALL DETERMINATIONS ARE AT 8 MINUTES, AND ARE MEANS OF FIVE TRIALS. CURVE 2 IS RE-DRAWN FROM FIG. 1.

When, in addition to varying the time of soaking, different temperatures were used, we found that there was less clot at 37·5° C. than at lower temperatures, the maximum being at about 25°. Fig. 1 shows the results. The experiments were obtained from randomized blocks, and statistical analysis shows that the conclusion is significant. In order to obtain a self-contained confirmatory experiment, another series of tests were made, using five different temperatures. The 25° optimum was once more observed, and the difference between the trials at this temperature and at the higher temperatures is again statistically significant. A further trial (1, Fig. 2), using more heavily impregnated lint showed that in this case the optimum at 25°, although observed, is not pronounced enough to be significant, but it is important to note that 37·5° was certainly not an optimum. Yet another trial (No. 4, Fig. 2), using heavily impregnated lint washed in a large quantity of water and dried before testing, yielded an amount of clot at 37·5° which was significantly lower than at any of the three temperatures 20°, 25° and 30°, affording confirmation under widely differing conditions.

We do not consider that our results conflict at all with the numerous experiments showing that the maximum rate of clotting is at about 37·5°, since we are measuring the total amount formed—a different question. Our results are consistent with the view that two processes are proceeding together, one being clot formation by thrombin and the other an

inactivation of the thrombin by the blood. If both processes have similar optima at about 37·5°, but different temperature coefficients, a peaked curve such as we find would result. In this connexion the 37·5° curve in Fig. 1 is illuminating, since the clot does not grow after the fourth minute, but actually becomes smaller, to an extent which is not significant from the statistical point of view, but may be real, and due to syneresis. Although some later workers have not found it, Landsberg[1] in 1913 reported a maximum clotting rate, under some conditions, at 25°, and our work appears to be confirmatory. There may be adaptive significance in the results, since clotting is normally required not in the recesses of the body, but at the surface, where the shed blood is not at 37·5° but at a lower temperature, whilst clotting in deeper and warmer positions is sometimes dangerous.

The details of the experiments will be published elsewhere.

R. MAXWELL SAVAGE.
W. P. CHAMBERS.

The Laboratories,
S. Maw, Son and Sons, Ltd.,
New Barnet, Herts.
Jan. 7.

[1] Landsberg, W., *Biochem. Z.*, **50**, 245 (1913).

d-Glyceric Aldehyde and Tumour Glycolysis

IT was found some years ago[1] that *dl*-glyceric aldehyde inhibits glycolysis of tumour cells. Anærobic glycolysis is inhibited about 75 per cent by 10^{-3} M., whereas aerobic glycolysis is not affected by this concentration. Aerobically, it takes four times this amount to produce the same effect. Concentrations higher than 4×10^{-3} M. of the aldehyde are toxic.

In 1932 experiments were carried out with *d*-glyceric aldehyde kindly supplied by Dr. A. I. Virtanen of Helsingfors (Finland). As this compound was prepared by bacterial action on *dl*-glyceric aldehyde, there was some doubt as to its purity and we hesitated to publish our results. Now having obtained the pure *d*-glyceric aldehyde prepared synthetically by Prof. H. O. L. Fischer and Dr. E. Baer, of Toronto, to whom we are much indebted for a gift of the aldehyde, we were able to reproduce the results obtained five years ago, thus confirming the purity of Dr. Virtanen's preparation.

On April 19, 1932, we found that 10^{-3} M. of racemic glyceric aldehyde inhibited anærobic glycolysis of Jensen rat sarcoma 74 per cent, whereas the same concentration of *d*-glyceric aldehyde gave only the slight inhibition of 11 per cent. With 2×10^{-3} M. we found inhibition of 91 per cent with the racemic and 33 per cent with *d*-glyceric aldehyde.

In recent experiments carried out with the new synthetic preparation the following results were obtained:

INHIBITION OF ANAEROBIC GLYCOLYSIS OF RAT SARCOMA 39 BY GLYCERIC ALDEHYDE.

Conc. of Aldehyde	Racemic	*d*
10^{-3} M.	78 per cent	0 per cent
	68	3
	74	0
2×10^{-3} M.	95	33
	84	32
	92	33

INHIBITION OF AEROBIC GLYCOLYSIS OF RAT SARCOMA 39 BY GLYCERIC ALDEHYDE.

Conc. of Aldehyde	Racemic	*d*
2×10^{-3} M.	52 per cent	12 per cent
3×10^{-3} M.	66	18
4×10^{-3} M.	83	31

As the strong inhibition of tumour glycolysis found with small amounts of racemic glyceric aldehyde is not brought about by the *d*-component, the effect is obviously due to the *l*-form, which therefore should be at least twice as effective as the racemic. Lately some experiments have suggested the possibility that *l*-glyceric aldehyde may even be three to four times as active as the *dl*-form.

In this connexion it is noteworthy that J. Needham[2] recently obtained similar results in his most interesting experiments with *d*-glyceric aldehyde on glycolysis of chick embryo. We are able to confirm his results.

Addendum, January 3: With a new sample of *d*-glyceric aldehyde, just obtained, no inhibition either of anærobic or ærobic glycolysis was found with concentrations given in the above tables.

BRUNO MENDEL.
FRIDA STRELITZ.
DOROTHY MUNDELL.

Department of Medical Research,
Banting Institute,
University of Toronto.
Dec. 28.

[1] Mendel, B., *Klin. Woch.*, **8**, 169 (1929).
[2] Needham, J., and Lehmann, H., NATURE, **140**, 198 (1937). *Biochem. J.*, **31**, 1210, 1913 (1937).

Drift of Net Assimilation Rate in Plants

IN reply to the letter from R. F. Williams[1], may I say that I much regret not having mentioned his paper[2] and that of Ballard and Petrie[3] in my note on the effect of age on net assimilation and relative growth-rates in the cotton plant[4], but I have just seen them for the first time. In stating that the absence of general trend of net assimilation rate up to time of flowering in my experiments was not *proved*, I was merely mentioning an inherent characteristic of the statistical test of significance. In testing the significance of a linear regression coefficient, the hypothesis is made that its true value is zero. This hypothesis may be disproved, at a given level of significance, in which case a significant general trend is shown, but it can never be finally *proved*. My results were clearly consistent with the hypothesis that the linear regression of net assimilation rate on time up to first flowering was zero, that is, that there was no general rise or fall, and it would seem, therefore, that to claim that my data confirmed the findings of Gregory[5] for barley was justifiable. Furthermore, my results agreed with those obtained for cotton by Crowther[6] in the Sudan, although no rigid statistical test was in the latter case applied.

With regard to the contention that the basis of estimation is important, it is worth noting that conversion of my data from a dry weight to a leaf area basis would introduce a rising tendency, since the area per unit leaf dry weight for the cotton plant falls somewhat in time[7]. If a significant upward trend were thus produced, my results for cotton would conflict even more markedly with the findings of Ballard and Petrie, and of Williams, that the net assimilation rate falls in time during the vegetative phase.

In using the term "flowering", Williams presumably refers to anthesis. So far as Gregory's results for barley are concerned, he claimed only that net assimilation rate was independent of time up to maximum leaf area, that is, for about the first six weeks, which corresponds with the stage of first differentiation of the flowers, not anthesis. After this point he also noted a rapid fall in net assimilation rate. For only one of the two experiments on oats described by Williams[2] does he appear to have obtained "unit leaf rate" data before six weeks, and in this case the rate appears to be remarkably constant up to 4–6 weeks. In so far as the cited experiments with temperate cereals are concerned, the results thus appear to confirm Gregory's findings. In the case of the single experiment with Sudan grass[3], the unit leaf rate appears to fall from the first observation (two weeks). It would be interesting to know the time of differentiation of flowers in this species.

The further interpretation of the data will be awaited with interest.

O. V. S. HEATH.

Research Institute of Plant Physiology,
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London, S.W.7.
Jan. 17.

[1] Williams, R. F., NATURE, **140**, 1099 (Dec. 25, 1937).
[2] Williams, R. F., *Austral. J. Exp. Biol.*, **14**, 165 (1936).
[3] Ballard, L. A. T., and Petrie, A. H. K., *Austral. J. Exp. Biol.* **14**, 135 (1936).
[4] Heath, O. V. S., *Ann. Bot.*, N.S., **1**, 565 (1937).
[5] Gregory, F. G., *Ann. Bot.*, **40**, 1 (1926).
[6] Crowther, F., *Ann. Bot.*, **48**, 877 (1934).
[7] Portsmouth, G. B., *Ann. Bot.*, N.S., **1**, 277 (1937).

Blindness in Freshwater Fishes

THE cause of blindness in some rainbow trout was recently described by me[1] as being due to a trematode, *Diplostomum volvens* Nord., being present in large numbers in the lens of the eye. Since that date, two more lots of rainbow trout and one lot of roach have been examined, and in each case about five per cent of the fish were blind, due to a similar cause to that already recorded.

I have also been informed from a reliable source that the disease is well known in Holland and other countries of Europe. Further, my attention has been directed by the Hon. Miss M. Rothschild to further literature of the subject, particularly to a recent account of this trematode by Wesenberg-Lund in his work on freshwater fauna[2] which records that *Diplostomum volvens* Nord. does not possess a direct life-cycle from bird to fish but that the fertilized eggs, which pass out of a water bird, develop into a miracidium which penetrates a molluscan and there produces the asexual cycle generation of sporocysts. These in turn give rise to fork-tailed cercariæ, which in due course escape from the snail or first intermediate host into the water. It is at this stage that the worm enters the second intermediate host.

The cercariæ penetrate the skin of the fish and reach the lens of the eye via the blood stream; the final host invariably acquires the parasite by eating fish which have become infected in this way.

WILFRID RUSHTON.

Biological Department,
St. Thomas's Hospital Medical School,
London, S.E.1.
Jan. 19.

[1] NATURE, **140**, 1014 (Dec. 11, 1937).
[2] "Ferskvandsfaunaen, Biologiste Belyst", Invertebrata, vol. 1. Trematoda-iken, pp. 123–127, Fig. 135–140; 1937.

Density of Living Aquatic Organisms

FOR some reason, the determination of the density of aquatic organisms has always presented to biologists a really difficult problem. The usual method has been to kill or narcotize the organisms and find the rate at which they sank in a liquid of known density, or alternatively to find a liquid of such density that the organisms floated or rather just did not sink in it. The density of the liquid was taken as the density of the organism. Neither of these methods need, I think, be seriously considered further. They may be suitable for minerals but scarcely for living organisms.

There is a very simple and accurate method available and this is best described by giving an actual example. Three typical specimens of the common polychæte worm *Nereis diversicolor* were sent from Plymouth in a large jar of sea-water. They arrived in perfect condition. The jar was placed in a sink of cold water until the temperature was constant. A specific gravity bottle was cleaned, weighed and standardized. The bottle was then weighed full of distilled water at 7·4° C., which was the temperature of the water in the sink. It was then filled with the sea-water and weighed, and finally the three worms were introduced and the bottle again weighed.

The only remaining problem was then to find the exact volume of the worms. This was quite readily done by pouring the contents of the bottle after the last weighing into a 200 ml. flask. The worms were retained in a funnel with a small plug of glass wool. When practically all the sea-water had gone the worms were just rinsed with a little distilled water. (If this is thought objectionable a little isotonic solution of sodium nitrate could have been substituted, but actually this was quite unnecessary since the worms went straight back to sea-water and were alive after two days.) They were only in contact with the distilled water for a few seconds. The solution of sea-water in the 200 ml. flask was made up to the proper mark. We can call this solution *A*.

The same specific gravity bottle was then again filled with the sea-water and the contents washed into another 200 ml. flask. We can call this solution *B*. The two solutions have different concentrations which can be determined by a very simple titration with *N*/10 silver nitrate, which incidentally need be only approximately *N*/10. From these two titrations the exact volume of the worms is obtained. The accompanying figures give the density of *Nereis* fairly exactly. The last two figures should probably be disregarded since the density of *Nereis* must vary with such factors as the contents of the gut, etc., or the sex. Again, it represents the average density of the three worms. Finally, densities given to six places of decimals are meaningless unless the density of the distilled water has been redetermined since the discovery of heavy water.

Volume of S.G. bottle at 20° C. and 760 mm.	51·21 ml.
Weight of distilled water at 7·4° C.	51·4198 gm.
" " sea " " "	52·8384 "
" " sea-water plus *Nereis* at 7·4° C.	53·0733 "
Calculated density of sea-water at 7·4° C.	1·02766

Volume of *Nereis*. Titrations with silver nitrate *N*/10: 14·35 ml.; 12·91 ml.

$$\text{Vol.} = 51{\cdot}21 - \left(\frac{12{\cdot}91}{14{\cdot}35} \times 51{\cdot}21\right) = 5{\cdot}14 \text{ ml.}$$

			gm.
Weight of sea-water displaced by *Nereis*	= 5·14	× 1·02766	= 5·2822
" " " in bottle with "		= 52·8384 − 5·2822	= 47·5562
Weight of *Nereis*		= 53·0733 − 47·5562	= 5·5171

$$\text{Density of } \textit{Nereis} \text{ at } 7{\cdot}4^\circ \text{ C.} = \frac{5{\cdot}5171}{5{\cdot}14} = 1{\cdot}07336.$$

The method is applicable to freshwater animals, but to find their volume they are placed in a 100 ml. flask and 25 ml. of a 1 per cent solution of glucose added. The concentration of the glucose is easily determined by MacLean's blood sugar test, while the solution of glucose is too weak to have any effect on osmotic pressure. Again, the rate of diffusion of glucose is far too low to have any effect on the tissues except perhaps on naked protoplasm itself.

The density of several living organisms has been determined in this way. Thus the density of the living three-spined stickleback at 10° C. was found to be 1·00286 swimming in Marlborough tap-water with a density of 1·00011 at the same temperature. The density of any living tissue can be determined in the same way provided a suitable Ringer solution is available.

A. G. LOWNDES.

Marlborough College,
Wilts.
Jan. 12.

Salaries in Soviet Universities

THE equivalent figures given in NATURE of December 11, p. 1007, namely, 1100 rouble = £42, are about three times too high on the actual purchasing power of these salaries. Sir Walter Citrine has published a thorough study of prices and standard of living in Russia[1], and finds the purchasing power of the rouble for food and necessities of life is equivalent to 3*d*. in England. This figure is confirmed by Andre Gide and Trotsky in recent books, and I have myself gone very thoroughly into the matter and would say that for January 1938 this is still not an unfair estimate[2]. On this basis the Russian salaries are as follows:

Directors of chairs in universities	=	average £190	per annum.
Professors	=	„ £175	„
Senior lecturers	=	„ £120	„

First-year students, at 130 roubles per month, are paid the same as the mass of unskilled workers in Russia, equivalent to 8*s*. 4*d*. per week in Great Britain.

The services received free in addition to salary, while not negligible, are, owing to overcrowding, very much curtailed compared with our own as received by the poorer members of the community in England; for example, the schools are usually run in two shifts per day and some even in three shifts.

Of the 542,000 students attending higher educational institutions, probably not as many as 5 per cent approach the standard of training and have the facilities we understand by university education; the rest receiving a training corresponding more to the higher forms of secondary schools, evening classes, etc.

Most of us would be glad to see a rise in the standard of living in Soviet Russia, but at present it is deplorably low, even more as regards wages than salaries.

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Withington,
Manchester.
Jan. 17.

[1] "I Search for Truth in Russia", by Sir Walter Citrine (1936).
[2] Cf. articles in *Manchester Guardian*, "Russia under Stalin—Wages" (Oct. 1937).

Apparent Enlargement of the Sun at the time of Rising and Setting

I HAVE always thought that the accepted explanation of the apparent enlargement of the sun, moon and constellations near the horizon was that we look on the sky as a very shallow inverted bowl, and therefore look on the horizon as very much farther off than the zenith. The sun having the same angular diameter wherever it is seems a larger body when on the horizon because we apprehend it as being much farther off than when in a high altitude.

The experiment described by Mr. Trotter in NATURE of January 15 supports this. It is not necessary to wait for sunshine to repeat it; look at an electric lamp until a retinal after-image is formed; look at a sheet of paper held at reading distance and then hold it at arm's length; the after-image will apparently increase in size.

There is another observation which bears on the same point. I have not seen it described and only noticed it for the first time last summer in Chichester Harbour: look down on to a perfectly still sheet of water at night; the constellations near the zenith look absurdly small; the mind places them on the surface of the water quite close at hand. To me the reflected constellations look only half the size of the real ones in the zenith.

C. J. P. CAVE.

Stoner Hill,
Petersfield.
Jan. 16.

Axial Spin of Arrows

THE correspondence referring to the feathering of arrows[1] recalls some seen at Parà about the beginning of the century in a collection of various gear and costume of the Amazon Indians. It would seem that these folk liked their arrows to spin, for at any rate some of them were feathered with fairly long narrow feathers, the tips of a pair were bound on opposite sides near the butt and again tied further along the shaft again on opposite sides but with a half turn; so that one feather was on one side at the end and on the other further along. If memory serves me, many of the feathers were those of the 'arà' or macaw, of which, too, were made wonderful helmets or head-dresses.

H. E. DURHAM.

14 Sedley Taylor Road,
Cambridge.

[1] NATURE, **140**, 1016 (Dec. 11, 1937); **141**, 123 (Jan. 15, 1938).

Prof. Alfred Lodge

MAY I add a few words to the obituary notice of Alfred Lodge, written by one whom I count amongst my friends? I had the privilege of being taught mathematics by Alfred Lodge, and although I was a mere boy at the time, I remember distinctly realizing my good fortune in having a teacher quite out of the ordinary. Whereas others taught us the usefulness of mathematics, it was Alfred Lodge who impressed on us its beauty. Under his influence one acquired the attitude towards any problem that it was not completely solved until one had found the neatest solution. Sometimes direct attack on a problem had led to a surprisingly simple result, and I remember how on such occasions Lodge would be asked either by a colleague or by a pupil if he could

not find a more elegant derivation. It usually took him less than half an hour to produce it. The affectionate regard that we as schoolboys had for him was reflected in his nickname, "Daddy Lodge".

E. A. G.

Jan. 28.

A New Monochromator

In a letter published in NATURE of January 22, I described a monochromator based on the principle of interference of polarized light in a number of quartz plates, and some experiments carried out with such an instrument. From a private communication received from Dr. B. Lyot on January 29, I have learned that much the same principle for the construction of a monochromator was outlined by him in the *Comptes rendus* of the Paris Academy of Sciences in December 1933. Dr. Lyot did not plan to use Polaroid film in his construction, and has not yet completed an instrument according to his design. I regret the omission of reference to his work, with which I was unfortunately completely unaware when I wrote my letter.

YNGVE ÖHMAN.

Stockholm Observatory.
Jan. 29.

Points from Foregoing Letters

A METHOD whereby ultracentrifugal sedimentation diagrams, giving the shape of the curve relating concentration gradient to distance from the axis, may be obtained by direct photography, is described by J. St. L. Philpot. The *Schlieren* principle is used together with a diagonal edge and cylindrical lens.

Prof. Z. Bay states that the sensitivity of the electron-multiplier tube with cæsium electrodes, when used as an electron-counting device, is greatly improved by cooling in liquid air, so that no spurious electrons shall be liberated by thermal agitation. Another disturbing factor, the leakage current, can be eliminated by suitable spacing of the lead-in wires and by insulation in dry nitrogen. The improved apparatus can be used for counting low-speed electrons generated in a vacuum, by vacuum processes only.

The effects of injection of the cancer-producing substance methylcholanthrene upon the body weight and metabolism of rats have been investigated by Dr. L. Havas and E. Gal. They find that this substance brings about fat deposition on various organs of the abdominal cavity. This effect can be counteracted to some extent by simultaneous injections of lettuce or mistletoe extract. Methylcholanthrene also brings about an increase in the rate of cell division and renders certain cells more sensitive to the action of colchicine.

A spontaneous discharge of impulses has been recorded by A. Sand from an isolated preparation of ampullæ of Lorenzini over a period of 24 hours. This furnishes complete evidence that these organs possess an autonomous rhythm of activity.

In support of his view that the hormones pitocin and pitressin (found in the pars nervosa of the pituitary) are secreted by special cells, pituicytes, M. Griffiths points out that the hormones are present in all classes of vertebrates where pituicytes are found. Since pitocin was found by Geiling and Lewis in tissue cultures of pars nervosa which were free from nerve fibre terminals, the latter cannot be responsible for the secretion of the hormones.

Referring to Dr. R. Deanesly's recent account of adrenal cortex differences in male and female mice, Dr. W. Cramer states that the adrenals of mice of inbred strains may show abnormalities, and should, therefore, not be used for the interpretation of histological changes in the adrenal of normal mice. Dr. Deanesly considers that, although the *X*-zone in the female may vary in different mice, its presence is independent of inbreeding or pathological conditions.

R. Maxwell Savage and W. P. Chambers show that the size of blood-clots formed by thrombin-impregnated cotton is at a maximum not at body temperature but below it. They attribute this to differences in the temperature coefficients of clotting and inactivation, and suggest that it is one of the adaptive mechanisms by which intravascular clotting is avoided, since normally clotting is required in shed blood at about the optima found.

Dr. B. Mendel, F. Strelitz and D. Mundell report that, unlike the racemic *dl*-glyceric aldehyde, the dextro-rotatory form, *d*-glyceric aldehyde, does not inhibit the transformation of glycogen to lactic acid by tumour cells. This confirms results of unpublished experiments carried out several years ago by the authors with *d*-glyceric aldehyde obtained by the action of bacteria upon the racemic form. The inhibition of glycolysis is apparently to be ascribed to the lævo form, the activity of which may be several times as high as that of the *dl*-form.

Replying to a letter from R. F. Williams on the time drift of net assimilation rate in plants, O. V. S. Heath points out that a re-examination of the published data of Williams and of Ballard and Petrie indicates that their contention of a fall in net assimilation rate before flowering does not apply to the first six weeks (flower differentiation) in the case of temperate cereals. This is precisely what Gregory found for barley, while Heath himself found no fall in cotton before first flowering.

Referring to his recent note on the blindness of freshwater fishes caused by the trematode *Diplostomum volvens*, Dr. W. Rushton quotes further references indicating that the parasite does not possess a direct life-cycle from bird to fish, but passes as an intermediate stage through a mollusc, where it produces the asexual cycle generation of sporocysts.

A. G. Lowndes describes a simple indirect method for determining the specific gravity of aquatic organisms. It employs the usual specific gravity bottle and determines the volume displaced by the organism by chemically titrating some constituent present or added to the water, for example, chlorine in sea water or glucose added to fresh water.

Research Items

Duration of Life in Prehistoric Man

DR. HENRI V. VALLOIS, in view of the fact that the age of the individual in the study of skeletal remains of prehistoric man has been treated as a matter of secondary importance, has endeavoured to arrive at a more precise statement of the facts on the recorded evidence and in the light of a personal examination of a number of the specimens (*L'Anthropologie*, **47**, 5–6). Of two criteria of age, the evidence of the teeth and the closure of the sutures of the cranium, the latter is taken as the more generally trustworthy and suitable for this purpose. The evidence is classified as Neanderthal, upper palæolithic and mesolithic. On the whole, the striking fact emerges that the life of fossil man was short. Of one hundred and eighty-seven subjects of determinable age, 55 per cent Neanderthal, 34·3 per cent upper palæolithic and 37 per cent mesolithic subjects died before reaching the age of twenty years; while of the remainder, the majority, 40 per cent Neanderthal, 53 per cent upper palæolithic and 58·5 mesolithic, died between twenty and forty years. Of the remaining sixteen, 5, 10·8, and 1·5 per cent respectively died between forty and fifty years, while only three survived the age of fifty years. Yet even these three had not attained true old age, as important sutures were still not closed. In addition to the numbers given above, there were thirty-one specimens for whom it was not possible to determine the exact age; but of these nineteen were not yet adult, and it is practically certain that the remaining twelve had not attained old age. These additional specimens bring the total up to 218. Notwithstanding defective evidence, there would appear to be a marked increase in the duration of life in the Bronze Age and among the Egyptians of the Roman period. In the fossil groups, man appears to have lived longer than woman. Especially below the age of forty is feminine mortality higher. As regards the cause of the early mortality, so far from civilization having shortened the natural span of life by 'dysharmonics' as Metchnikoff thought, it appears to have lengthened it.

Easter Island Inscriptions

DR. A. METRAUX, Bishop Museum fellow, figures and describes in *Man* of January two inscribed tablets and an inscribed fragment from Easter Island, now in the Bernice Pauahi Bishop Museum, Honolulu, which have not been recorded by those who have written previously on the subject of the Easter Island inscriptions. Sixteen authentic tablets deposited in various institutions are now known. Most of these have been described. When the Easter Island tablets were first discovered the islanders were perfectly willing to part with them; but the modern natives, realizing the interest taken in them by Europeans, have manufactured imitations. The tablet acquired by the British Museum in 1903 is probably modern in origin. The signs are poorly engraved and suggest the style of modern artists. Faked tablets were made in the island even prior to 1882, as witness a faked gorget in the Australian Museum. The two tablets of the Bishop Museum are in poor condition, the wood being partly rotted away. Signs appear on one side only, the other side being decayed. The best preserved specimen is twelve inches long, three and three-quarter inches wide and three-quarters of an inch thick. The signs are incised according to the best classical tradition. The symbols have been engraved with an obsidian or shark's tooth point. The signs form eleven rows; of the characters, one hundred and twenty are legible. The rows of signs are reversed alternately. The second tablet, twenty-seven and a half inches long, three and a quarter inches wide, and one inch thick, contains twenty-five unobliterated signs around a natural hole in the wood. A few years ago it was suggested by Mr. de Hevezy, a Hungarian linguist, that there were striking and incontrovertible parallels between the Easter Island script and the Indus Valley inscriptions from Mohenjo-daro and Harappa. It is now shown that the resemblances were due to inaccurate reproductions of both groups. The only resemblances are simple geometrical signs. The Hungarian author suggested that the Easter Island signs might be thousands of years old; but the largest tablet in existence in the Museum of Brain-Lecombe is carved on a European oar.

Effectiveness of Administered Hormones

THE preparation in pure form of the products of those endocrine glands which produce chronic effects in the body, has had the untoward result of making more difficult the experimental or therapeutic imitation of their actions. The hormones of the gonads, anterior pituitary and adrenal cortex and insulin appear to be utilized or eliminated soon after they enter the circulation, and in these circumstances their physiological effectiveness depends very largely on the method by which they are administered. Thus, a given dose of œstrone in aqueous solution is known to be more effective if given in a series of divided doses than when given in a single large dose; similarly, esterification of œstrone and of androsterone and testosterone has been found to increase their activity; but whether this increase in activity was due to delayed absorption or to slow hydrolysis after absorption was not clear. Drs. Deanesly and Parkes (*Proc. Roy. Soc.*, B, **124**, 279; 1937) have recently studied the variations in effectiveness of a large number of gynæcogenic and androgenic compounds brought about by different methods of administration, involving subdivision of the dose, the nature and volume of the solvent, the addition of fatty acid, esterification and mode of administration. It is clear that the increased effectiveness of the esters is due to delayed absorption from the site of injection, since they are no more effective than the free hormone, when both are given intravenously. The esters are most effective when given in such a form that they might be expected to crystallize out in the tissues, and this finding led the authors to investigate the effects of giving the hormone by subcutaneous implantation of crystals or compressed tablets. This method was found to be extremely effective. A further advantage of the method is that, at the end of the experimental period, the tablet can be removed and weighed, and a reasonably accurate determination made of the actual amount of hormone absorbed.

Control of the Bed-bug

THE common bed-bug, *Cimex lectularius*, has spread during recent years to an extent that probably about four million people in Greater London alone are, to some degree, troubled by this pest. Slum clearance campaigns have caused the demolition of many bug-infested quarters. Unfortunately, in many instances precautions were not taken to eradicate the bed-bugs before the families moved into their new homes. The result has been that new colonies of the insect have been founded and new areas, formerly free from the pest, have now become infested. Probably the chief means of dissemination is the carriage of bed-bugs in furniture and bedding, but there are many other methods of lesser importance. While bed-bugs do not transmit any actual disease in Great Britain, the constant irritation due to the injection of minute doses of the insects' saliva into the blood is likely to contribute largely to the ill-health of children and even sometimes of adults. The habits, behaviour and means of control of this insect are dealt with in a pamphlet on the subject, entitled "The Bed Bug" and issued by the British Museum (Natural History) as No. 5 of the Economic Series. This pamphlet, which is in its fourth edition (1937), is written by Mr. A. W. McKenny-Hughes, assistant keeper in the Department of Entomology. It is obtainable either from the Museum or through booksellers, price 6*d*.

Genitalia of Hymenopterous Insects

THE attention of students of insect morphology is directed to a paper by Mr. O. Peck (*Canadian J. Res.*, 15*D*, 221; 1937) which embodies an illustrated account of the structure and supposed homologies of the male genitalia in the Hymenoptera. Four main components are distinguishable in these organs. (1) An annular basal gonocardo which bears a pair of claspers (2), and each of these latter carries an inner clasper or volsella (3). A median organ or ædeagus (4) with a pair of lateral parameres or sagittæ are supported by the claspers and volsellæ. The true homologies of these parts are very uncertain and have not as yet been definitely established. The remainder of the paper is devoted to a detailed study of the male genitalia of the Ichneumonidæ in particular. This account is to be completed in a later issue of the *Journal*.

Anatomy of Protobranchs

PROF. HAROLD HEATH in his paper "The Anatomy of some Protobranch Mollusks" (Mémoires du Musée royal d'Histoire Naturelle de Belgique, deuxième série, fasc. 10, 1937) shows several important points in connexion with the comparative study of various species belonging to six genera obtained from both Atlantic and Pacific coasts: *Nucula* (10 species), *Acilia* (4 species), *Yoldia* (8 species), *Yoldiella* (2 species), *Malletia* (one species), *Leda* (6 species). It is shown that the muscular system in all is very similar, the pedal muscles especially being complicated. It is interesting that differences exist between the specimens of *Yoldia thraciæformis* from the Atlantic and Pacific, the western representatives being considerably smaller than the eastern, yet all are sexually mature, and the larger individuals possess certain small muscles in the vicinity of the anterior adductor which are apparently not present in the smaller form. In studying the digestive system, the author finds that the simplest types of intestine occur in *Nucula* and *Acila* from shallow water, between 5 and 125 fathoms, whilst in the deeper water species of *Nucula* it is much more complicated. However, *Yoldia*, *Yoldiella*, *Malletia* and *Leda* possess intestines of the same relative length and with the same arrangement in species from all depths ranging from 11 to 1569 fathoms. There thus appears to be in *Nucula* a correlation between length of intestine and depth; but it is carefully stated that too few specimens have been examined as yet to be quite sure of the fact. "If such be the case it may be that nutritive material diminishes according to depth and that complete digestion and absorption of food demands correspondingly elongated intestines".

Vitamin C in the Potato

FOLLOWING the publication by Ijdo of work on the vitamin C content of different varieties of potato (cf. NATURE, 140, 977–78; 1937), A. M. Smith and W. Y. Paterson record in the *Biochemical Journal* (31, 1992–9; 1937) results which confirm and extend those of the Dutch investigator. These authors examined a large number of tubers, from the 1935, 1936 and 1937 crops, for ascorbic acid, using the usual method of extraction with trichloroacetic acid and titration with 2 : 6-dichlorophenol-indophenol, and also a modification of it suitable for rapid routine testing. They found that the vitamin C content varied with the variety of potato and with the time and temperature of storage, but was independent of size and weight of tuber, of environment, including soil conditions and manuring, and possibly season. They also discovered that the content was significantly higher in tubers suffering from mosaic disease or leaf-roll. Therefore, determination of ascorbic acid in potatoes affords not only a method of identifying variety, but also of testing the presence of virus disease, under uniform storage conditions. The test should assist growers in selecting stock seed for the next season's crop.

A Criticism of Warnstorf's "Sphagnologia Universalis"

As the result of a visit to the Warnstorf Herbarium at Berlin-Dahlem, A. le Roy Andrews expresses his opinion that the Warnstorf "Sphagnologia Universalis" is "inflationary" and needs drastic revision (*Ann. Bryologici*, 9, 1936. Leyden. British agents, Dawson, London). As a new and simplified classification Andrews suggests that the two main sections (termed sub-genera by Andrews) *Inophlœa* (*Cymbifolia*) and *Litophlœa* (the other groups), which date back to Russow, still stand, but the sub-sections of these according to Warnstorf appear to be of unequal rank. Andrews separates *Rigida* under Müller's name Section *Malacosphagnum* from the remaining groups which fall under Section *Acisphagnum*. As a result of careful comparison, it is also suggested that Warnstorf's eight groups of *Litophlœa* (exclusive of *Rigida*) may justifiably be reduced to three: A. Series *Squarrosa*, B. *Cuspidata* (including *Subsecundum*, which appears to have no fundamental distinction from *Cuspidata*) and C. *Acutifolia*. This classification is based on the usual characters of leaf section, pores, etc., in conjunction with certain features of specialized stem leaves and perichætial leaves. Andrews points out that the presence or absence of fibrils needs to be used with caution, as also the degree of exposure of chlorophyll cells; the latter, as shown by Russow, have equal exposure at both surfaces in initial stages and only reach unequal

exposure during subsequent development. In Warnstorf's "Sphagnologia" 342 *Sphagnum* species are described and to these subsequent additions have been made. Andrews doubts that any really critical student could confirm at most more than a 100 good species.

Antirrhinum Rust

A SEVERE infection of antirrhinum plants in 1934 by the rust fungus *Puccinia antirrhini* stimulated the prosecution of much intensive research on the disease by D. E. Green, mycologist to the Royal Horticultural Society. The text of a lecture which reviewed these investigations is now published in the Society's *Journal* (62, Pt. 12, pp. 530–537, Dec. 1937). Antirrhinums in Canada, California and Bermuda have been attacked very severely by the fungus for a decade or more, but the disease had not been reported from Europe prior to 1933. Uredospores are produced, and also teleutospores, which, however, have not been found to re-infect snapdragon plants. The method of overwintering is still a problem, but the most obvious means would appear to be persistence of the fungus in perennating antirrhinum plants in frost-free localities. Uredospores appear thereon in the following summer, and infect other plants. Spraying is an exorbitant and economically ineffective control, but Mr. Green's lecture ended with an account of progress with rust-resistant snapdragons. Some American strains can claim 70–90 per cent resistance, largely at the expense of their horticultural beauty, but the results of work in 1937 at the Society's gardens at Wisley show that a number of more attractive strains obtained by crossing have achieved 50–75 per cent resistance.

Leaf Diseases of *Narcissus*

DR. P. H. GREGORY has collected information upon diseases of *Narcissus* leaves, in the Royal Horticultural Society's Daffodil Year-book for 1937. *Narcissus* leaf scorch is caused by the fungus *Stagonospora Curtisii*; white mould results from the activities of *Ramularia Vallisumbrosæ*, whilst a grey mould is induced by *Botrytis narcissicola*. *B. polyblastis* is responsible for the condition known as 'fire'. *Narcissus* 'stripe' is probably caused by a virus. Symptoms, life-histories and control are described from a horticultural aspect, and the paper should prove a useful review for the practical grower.

New Zealand Earthquake of June 17, 1929

MR. J. HENDERSON, the director of the New Zealand Geological Survey, has written a detailed report on this earthquake (*N.Z. J. Sci. and Tech.*, 19, 65–144; 1937). Its origin lay near Murchison along a fault directed a few degrees east of north. During the earthquake, the crust on the east side rose over a length of about five miles, especially where the fault crosses the Buller River. A few years before, bench-marks were laid along the railway line of the district. They were re-observed in August 1929, and again in March–July, 1930. The first measurements showed that, to the west of the fault, there was an uplift of 5 ft., dying out within one quarter of a mile. At the fault itself, the uplift of the east side was 14 ft. 9 in., rising to 16 ft. in about a mile, and decreasing irregularly to zero at a distance of about 15 miles. The interval between the two surveys was marked by a general settling of the crust in four blocks. In that nearest the fault, about one mile wide, the changes were small. The next, about three miles across, was uplifted, at one point by 3 ft. 3 in. In the third, five miles wide, the crust sank uniformly by about 18 in.; while, in the fourth, of slightly less width, the subsidence decreased from about 17 in. to zero. The only evidence of horizontal displacement was provided by shifts in the railroad near the fault. Three points on the west side were moved about 4 in. west; while, on the east side, the average movements of five points were 9 ft. 5 in. north and 7 ft. 10 in. west. The terminal stations on the west side, distant 242 yards, are now nearly 6 in. farther apart, while those on the east side, distant 594 yards, are now nearer by 27 in.

Crystal Structure of Uranium

THE X-ray powder diagrams of uranium found by C. W. Jacob and B. E. Warren (*J. Amer. Chem. Soc.*, 59, 2588; 1937) indicate that the structure can be considered as a deformed hexagonal close-packed structure with four neighbours closer than the other eight. From its position in the periodic table, it might be suspected that uranium would have the body-centred cubic structure of chromium, molybdenum and tungsten, but this is not the case. It is also found that the densities of chromium, molybdenum and tungsten, when plotted against the atomic numbers, fall on a smooth curve, whilst uranium is off the curve. The structure of uranium is quite different from that of any other element. The only element which is in the same column of the periodic table and shows any relationship to uranium is neodymium, which crystallizes in the close-packed hexagonal system. The structure of uranium is essentially that of a pseudo-metal such as antimony or gallium. The four closest neighbours in the crystal structure indicate a tendency to form four covalent bonds.

Compensation of Spherical Aberration in Telescopes

C. R. BURCH has recently published a paper (*J. Brit. Astro. Assoc.*, 48, 3, January 1938) in which he describes his experiments with an under-corrected Newtonian telescope, of aperture 9½ in. He cancelled the spherical aberration by means of a compensating plate—a "pseudo-plane-parallel" glass plate having spherically aberrant surfaces, placed at a suitable distance in front of the eyepiece. When this compensator was in its best position, stellar images at focus appeared appreciably smaller and lunar detail appeared sharper. While Mr. Burch does not suggest that compensators should be used for imperfectly figured mirrors, nevertheless as compensators of the low power required are easy to figure, they might prove extremely useful. During the discussion, Mr. F. J. Hargreaves suggested that a compensator mounted in a tube with rack and pinion might be utilized to allow for changes in spherical correction occurring during observing. Capt. M. A. Ainslie remarked that he had once utilized the spherical aberration of an ordinary biconcave lens, mounted a few inches in front of the eyepiece, to compensate for under-correction, the spherical aberration of the lens being opposite to that of the mirror. Those who use reflectors should read the paper and also the account of the proceedings of the meeting. They will derive a considerable amount of useful information on methods for dealing with under-corrections.

Science in India

ONE of the many happy results of sending a delegation from the British Association to the Silver Jubilee Session of the Indian Science Congress Association has been to arouse among the universities and scientific institutions in Great Britain a wider interest in the scientific work of India. As most of the delegates have now returned, the British Association may perhaps provide an opportunity for some of them to speak upon this subject, but meanwhile a good impression of the Congress can be gained from two of its publications that have now reached this country; namely, the *Proceedings*, and the "Outline of the Field Sciences of India"—volumes which correspond in a general way with publications of the British Association.

The "Outline" contains admirable accounts of the natural conditions of India and it is hoped that copies may be readily obtainable by scientific libraries. Dr. C. W. B. Normand begins with a concise account of the weather of India, in which he sets out clearly the phenomena of the monsoons that play so large a part in Indian life. The surrounding oceans are described by Lieut.-Colonel Seymour Sewell, and the geological history by Mr. D. N. Wadia: both chapters are full of information and in a short compass give the reader a clear idea of the physical environment, while Mr. Calder, Dr. Srinivasa Rao, and Sir Bryce Burt deal respectively with the flora, the fauna and the agriculture. Accounts of the racial ethnology and of the archæology by Dr. B. S. Guha and Rao Bahadur Dikshit complete an unusually interesting volume.

The *Proceedings* give a general impression of the extraordinarily wide range of subjects discussed by the Congress. As in the British Association, there are thirteen sections, though they are not identical in the two organizations, the Indian Congress including sections on entomology, medical research, and veterinary research, but not on economics, engineering or education. Well over eight hundred papers were presented: more than two hundred of these went to the chemistry section, while physics and medical research each had just under one hundred. Some of the laboratories from which this work has come are of course well known in Great Britain: Calcutta, Dacca, the various colleges at Madras, Bangalore, Allahabad, Bombay, Benares, but on looking through the volume one sees the names of other laboratories not yet as well known but where, nevertheless, much research activity is being shown.

This wide distribution of the research habit in the Indian colleges and universities is perhaps the most pleasing feature that emerges from a study of the volume. Western science has not simply been admitted into Indian universities; it has been taken up with eagerness and pursued by the Western method of experiment, observation and deduction. The extent of the development is all the more remarkable because of its recent growth: the founder of Indian chemical study, P. C. Ray, is still living, and the first experimental biologist, Jagadis Chandra Bose, has only recently died. Scientific investigation is very largely a modern activity in India, and there has been insufficient time for the evolution of a tradition of scientific work such as exists in the older laboratories of Great Britain, yet already men like Venkata Raman, Meghnad Saha, Birbal Sahni and others have made notable contributions to science and there are a number of younger ones whose work is full of promise for the future.

Hitherto it has been customary at the Indian universities to cast the net very widely, and the impression one obtains both from seeing the work and from perusing these summaries is of extensive rather than intensive investigation. Now that scientific work has begun to flourish so vigorously, it will become possible for the best of the leaders to impress their own high standards on their enthusiastic followers, and so ensure that Indian science may take its proper place in the laboratories of the world. There are, of course, many difficulties to be faced and overcome, but the results already achieved show what can be done, and it remains now to ensure to the gifted Indian worker the best conditions for development and for self-expression.

E. J. RUSSELL.

SOURCES OF ENERGY OF STORMS

The general theme of Dr. C. W. B. Normand's remarks in his presidential address to the Physics and Mathematics Section may be summed up as the thermodynamical approach to the study of storms.

At the basis of it all, following Margules, there is the simple enough proposition: if the whole air-mass around and including a storm can be circumscribed and considered as a closed system, it should be possible from a study of the initial and final conditions alone to decide the main source of the kinetic energy that has been created and displayed during the storm's existence. Before either the gravitational or the internal energies can decrease within a closed system, the stored-up energy must be present in a state of instability, actual or potential. The possible diversities of instability are believed to be composites of three main kinds, which for brevity are called the vertical, horizontal and latent types, the latter referring particularly to the instability that may arise from the latent heat of water vapour. Horizontal instability arises when two air currents of different temperature meet, as, for example, polar and tropical air. The horizontal and latent types are the two that can store up energy until favourable conditions allow its release. Latent instability develops behind a veneer of stability. It is analogous to the energy of a hydrogen balloon caught in the corridor of a large hall where it can be fed with more and more hydrogen but cannot escape up to the dome until given a relatively small, yet distinctly appreciable, push.

How are we to estimate quantitatively the relative importance of these main types of instability in originating storms? The standard method of attack is that of Margules, which, however, can be clarified and extended by graphical methods. The tempera-

ture-entropy diagram is chosen, with mass as a third co-ordinate. Solid models were shown, of which the volume represents the total energy available from a closed system, wherein all the elements rearrange themselves in the most efficient manner thermodynamically while passing from the initial unstable to the final stable configuration. In two simple examples of horizontal instability, one with discontinuous and the other with continuous change of temperatures, the volumes take the shapes of a wedge and a pyramid respectively.

The energy of a closed system in which latent instability alone is operative, can also be represented by the volume of a solid figure. Imagining a very extreme example and illustrating it by models, Dr. Normand stated that the average available energy may give rise to velocities of as much as 80 miles an hour, when the effect of rain on the descending air is neglected, and to a hurricane of 115 miles an hour throughout the mass, if full advantage is taken of the chance to saturate the descending air by the simultaneously falling rain. The atmospheric engine does not possess this ideal degree of efficiency but these calculations show how important latent instability may be, especially in the tropics.

The application of these ideas to dust-storms, thunder-storms and cyclones was briefly discussed. More field work is required to settle even the primary thermodynamical questions that should precede any full discussion of the dynamics of storms. The required upper air data must include reliable observations of humidity or of wet-bulb temperature as well as of air temperature. The Bay of Bengal, with its tropical cyclones, is ever a challenge to meteorologists in India.

Magnetism Relating to Chemistry

It is only within recent years that the magnetic properties of matter have attained the same order of usefulness as the electrical ones in the solution of chemical problems. Recent advances in this subject formed the topic of Prof. S. S. Bhatnagar's presidential address before the Chemistry Section. From the point of view of nuclear chemistry, the nuclear magnetic moments are of considerable importance to theories of the 'neutron-proton' constitution of nuclei.

The actual values of the nuclear moments, however, are very small relative to those arising from the orbital momentum and spin of the electrons, and the main part of the magnetic moments of free atoms and molecules thus arises from the motion of the electrons around the nucleus. The magnitudes of these moments can be determined directly with the help of the atomic and molecular beam deflection methods and the results have been found to be in agreement with theoretical predictions based on spectroscopic evidence. For example, oxygen atoms obtained in their normal ^3P state from an electrodeless discharge are found to have a moment of 1·67 Bohr magnetons; while similarly the magnetic moment of the iron atom has been found to be 2·03 Bohr magnetons. The paramagnetism of oxygen, sulphur and selenium vapours shows that the ground states of these molecules are triplet in character.

In liquids and solids, the magnetic properties of the free molecules are greatly affected by interaction with neighbouring molecules, but in special cases like the rare earths this effect may be very small on account of the deep-seated nature of the electronic orbits from which the paramagnetism arises. Magnetic susceptibilities have been found to vary along the different axes of a crystal and this has been made the basis of an auxiliary method for determining their structure. Thus, for example, the high diamagnetism of graphite in the direction normal to the basal plane is to be expected from its layer lattice structure.

Pascal's discovery that the diamagnetic susceptibilities of many organic compounds are an additive property shows that the atomic orbits are but little distorted by the molecular bonds, and deviations from additivity can be used to establish different electronic structures. Attempts have been made to extend this to electrovalent salts by considering the molecular susceptibility to be the sum of the ionic susceptibilities. It has been established that the ionic susceptibilities of the elements of the first transitional series arise from spin alone, the orbital momentum being completely inoperative for copper and manganese ions, though it does not seem to be altogether quenched for nickel and cobalt. In the rare earth ions, on the other hand, the contribution of the orbital momentum to the paramagnetism of the ions is appreciable since it arises from inner protected shells.

While the ions of the transitional metals of the first series are paramagnetic, some of the complex salts formed from them are diamagnetic, indicating that during the process of co-ordination, the unpaired electrons of the outer shells become paired and a closed (inert gas) configuration results. If the paramagnetism does not disappear, then the complex is presumed to be held together by weak electrovalent forces, for example, $Cu(NH_3)_4$. The recent application of this method to the elucidation of the structure of some constituents of the blood is of considerable interest. It has been shown from magnetic measurements that the oxygen molecule undergoes a profound change in electronic structure on attachment to hæmoglobin, and that the bonds from the iron to the surrounding atoms are ionic in hæmoglobin and covalent in oxyhæmoglobin and carbon monoxyhæmoglobin.

Magnetic measurements have also yielded valuable information regarding the existence of 'free radicals' and have made it possible to distinguish them from dimeric molecules. Information about processes of polymerization has been obtained from observations of the changes in mass susceptibility, and compounds have been detected in systems of alloys by the same method. It also appears that magnetic fields can influence the rate of chemical reactions if the total molecular susceptibility of the products differs from that of the initial substances.

Structure of the Himalaya and of the North Indian Foreland

Geological work carried out during the last few years, which was discussed by Mr. D. N. Wadia in his presidential address to the Section of Geology, has thrown much light on the structure of Northern India, a region of extraordinary geotectonic interest as much on account of the magnitude and intensity of the crustal deformations, involving the upwarp of the Himalayan chain and the formation at its foot of the deep parallel Indo-Gangetic depressions, as on account of the extreme youth of these world-transforming events.

The region of Northern India resolves itself tectonically into two broad belts, the plicated geosyncline of the Himalayas, and the edge of the Indian peninsular massif, that has acted as the foreland, and in the process sagged under the strain of the folding of the northern orogen. The structure of this foreland is revealed in four principal units: (1) The Rajputana plateau, prolonged northwards into the 'Punjab wedge' of Gondwanaland, which has played such an important part in moulding the trend of north-west Himalaya; its main tectonic strike is transverse to the Himalayan strike. (2) The Potwar trough, a tertiary geosyncline containing 25,000 ft. of fluviatile deposits. (3) To the south-east the Potwar geosyncline widens into the great synclinorium of the Gangetic trough, 1200 miles long and 200 miles wide, mostly filled up by late Pleistocene alluviation. (4) The Assam plateau, a tongue of the Gondwana mainland, has played the same part as the Punjab wedge in moulding the Himalayan trend at its eastern extremity. The Assam valley is a 'ramp' valley.

Few parts of the Himalayas have so far been investigated in detail for their structural plan. Areas in which detailed mapping and stratigraphic and tectonic work have been carried out are the Kashmir mountains, the Simla area, a part of Garhwal, and the neighbourhood of Mt. Everest, in Sikkim. In Kashmir the Himalayan system of earth-folds undergoes a deep syntaxial bend round a pivotal point—a narrow promontory of the Punjab foreland hidden under the late Tertiary deposits. The most important tectonic feature of this north-west Himalaya re-entrant are two concurrent thrust-planes delimiting the autochthonous fold-belt at the south foot of the Himalayas against the edge of the foreland, which have been traced around the syntaxis for a distance of 250 miles. The inner of these thrusts marks the front of the Kashmir *nappe* of pre-Cambrian and older Palæozoic rocks, which has moved southwards along a low plane of thrust and encroached upon the autochthonous belt of Carboniferous-Eocene succession, obliterating it at places. Four overthrusts have been noted in the Simla mountains, representing flat, recumbent folds of great amplitude. The Pre-Cambrian here is piled up on the Carboniferous and Permian sequence. The Simla rocks are totally unfossiliferous and the evidence of the superposition of highly metamorphosed pre-Cambrian, building some of the prominent peaks near Simla (*Klippen*) over the less altered younger rocks, is obtained by a study of relative metamorphism, unconformities, thrusts, etc. In the Garhwal area recent mapping has proved two superposed *nappes*, the Krol and Garhwal *nappes*, composed of the older rock-formations overriding the autochthonous Carboniferous-Eocene sequence of the Outer Himalayas.

Evidence of the extreme youth of Himalayan orogeny has multiplied in recent years; investigations in the Pleistocene, glacial and fluviatile deposits of the Kashmir valley suggest that some 5,000–8,000 ft. of uplift has taken place since the end of the Pliocene. A part of the address dealt with the recently discovered gravity anomalies, both positive and negative, in the Himalayan region, which cannot be explained on the hypothesis of isostasy. On the whole, compensation is in excess in the central Himalayan ranges, while the outer Himalaya is an area of overload and under-compensation.

The arcuate form of the Himalayas, presenting to the south three prominent festoons, is best explained as the result of three crustal pegs arresting the free movement of the plastic folds pressing against the Indian horst under pressures from the north. The Great Himalayan range, built mostly of granite or pre-Cambrian sediments, from the Brahmaputra gorge to Nanga Parbat on the Indus, thus denotes the Himalayan protaxis, the axis of original upwarp of the Tethyan geosyncline. At both its ends it has undergone sharp southward deflections to accommodate itself to the shape of the foreland.

[*To be continued.*]

Research on Crustacea from the "Discovery" Expedition*

VOL. 14 of the "Discovery" Reports is devoted to Crustacea and includes important memoirs on *Euphausia superba*, on the southern species of the genus *Euphausia*, and on Decapod larvæ. The whale krill *Euphausia superba* may be said to be the key animal of antarctic plankton. Its importance as whale food and its enormous abundance make it an ideal subject for research, and the authors of the respective monographs have utilized their unique opportunities to the best advantage. We now definitely know a considerable amount about the development, larval distribution and breeding of one species, the knowledge being based on the examination of a huge number of specimens. There is more to come, for at least another memoir is in progress which will deal with development and distribution of the adult animal. No member of the group has ever been studied so thoroughly as *Euphausia superba*, and the thorough study of this one species will serve as a basis for all future research.

Dr. Gurney's work on the Hippolytidæ is illuminating in many ways, and it is significant that, in this one family of the Caridea where nine larval stages are frequently present and not known to be exceeded, he should refer to both Fraser's and John's present accounts of the development of the Euphausidæ, noting that they find three *Calyptopis* stages and six (or rarely seven) *Furcilia* stages (the term *Furcilia* being used to include all stages between *Calyptopis* and post-larval). Now if we accept the interpreting of stages 1–3 of Caridea as equivalent to the *Protozœa* of Penæidea and the *Calyptopis* of Euphausidæ, as suggested by Gurney in 1926, the total number of possible stages in Caridea is precisely the same as it is in Euphausidæ—a fact certainly in favour of the placing of the Euphausidæ among the Decapods.

* Discovery Reports. Issued by the Discovery Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. Title Page and List of Contents: On the Development and Distribution of the Young Stages of Krill (*Euphausia superba*) (published December 7, 1936) by F. C. Fraser. The Southern Species of the Genus Euphausia (published December 14, 1936) by D. Dilwyn John: The Reproductive System of *Euphausia superba* (published June 25, 1937) by Helene E. Bargmann: Larvæ of Decapod Crustacea. Part 4. Hippolytidæ (published June 25, 1937) by Robert Gurney. Vol. 14. (Cambridge: University Press, 1937).

Fraser has established the principle that there are certain important essential *Furcilia* stages, recognized by the number and state of development of the pleopods, and that these stages predominate to such an extent that one must regard any intermediate stages as unessential and as occurring only occasionally. He also shows that breeding takes place in the deep water, and all early stages are found in the deep water of the far south; *Calyptopis* and early *Furcilias* in warm deep water and in the intermediate vicinity of antarctic surface water, but that the last *Furcilias* and adolescents are always found at the surface and at the ice edge. Adolescents remain at the surface but early stages have a well-defined diurnal migration. Miss Bargmann in her account of the reproductive organs of *E. superba* states that it is probable that the process of egg-laying takes place at a depth of 200 metres or more. She has dissected and examined more than 5,000 specimens in order to determine the state of development of the sexual organs. John describes the adult characters of ten species of *Euphausia*, including *Euphausia superba*, and the development of five others, with their distribution, which is exceedingly interesting; the genus in the cold southern waters consists of two groups of species, one reaching to the far south and each of the four species concerned occupying one of four successive zones of water from north to south, the other, which includes *Euphausia superba*, being circumpolar in range and not so successful in breeding and colonization.

Dr. Gurney is describing group by group the very large collection of decapod larvæ obtained by the *Discovery*. This is the fourth part and in it he has included certain members of the Hippolytidæ from the collection of the Great Barrier Reef Expedition and from his own collections from Gardaqa in the Red Sea. In so doing he has made a very valuable contribution to our knowledge of the larvæ of this difficult family, the larvæ of which are extremely varied and interesting. Besides describing much new material, he has summarized the larval characters in eight genera, and amongst other things has established the fact that Bate's peculiar larval genus *Eretmocaris* is a composite one, made up of a group of forms, probably mostly, but not all, belonging to the hippolytid genus *Lysmata* or some near relative. In thus summarizing our knowledge of the Hippolytidæ, Dr. Gurney shows how much more there is to be done and indicates the essential gaps which should be filled in order to understand the natural relationships of those larvæ.

Irrigation in Egypt

THE Irrigation Services of Lower Egypt, Upper Egypt and the Sudan are the subject of Part II of the annual report of the Egyptian Ministry of Public Works for the year 1929–30, which has only lately been issued (Cairo: The Government Press. P.T. 100). The control and distribution of the Nile waters according to the requirements and crops of the cultivated lands, and the safeguarding of the country from the possible dangers and losses of flooding are regarded as the first and principal duty of the Ministry. In broad terms, this consists in regulating the periodic variations in the river flow to meet the seasonal needs of the agriculturists and in adjusting the authorized croppage to the supplies of water likely to be available. To ensure that an adequate proportion of the plentiful flood waters is retained in storage in order to make up for the natural deficiency during summer, forecasts of the expected state of the river at all seasons are made from time to time, and on these forecasts programmes of distribution are made and progressively adapted as the situation defines itself more clearly. On these and the reports of conditions the Ministry also prepares and executes schemes for the improvement of the system and for the development of cultivable areas to provide for the steadily increasing population.

In the year under review, early forecasts made it necessary, in the first instance, to allot all the supply to the cotton crop, but later forecasts made in April resulted in a modification whereby it was possible, ultimately, to authorize the cultivation of rice areas to the extent of 400,000 feddan. In this year also, the forecasts indicated that the flood would be dangerously high, whereupon the necessary steps were taken to cope with this threat and to carry out such measures of defence and protection as were necessary. In the result, the flood passed safely and without serious accidents or cuts in the banks.

The report is very largely concerned with the day-to-day routine of records of flood, supply, distribution, discharges, allowances, etc., in each of the many areas into which the whole system is divided, and much of this work is illustrated by charts and diagrams. There are also particulars of the buildings, additions, repairs and other constructional and maintenance work undertaken to preserve and extend the facilities and advantages of this vital undertaking.

Closely connected with the work of irrigation in some of its services is the Physical Department, which also comes under the Ministry of Public Works and the report of which is included in this volume. It includes meteorological, hydrological and weights and measures services and a scientific instrument workshop where surveying and other measuring and scientific instruments are repaired, adjusted and calibrated.

The Meteorological Service in 1929–30 with 78 stations, and the Hydrological Service with 345 rainfall stations were very fully occupied in connexion with the needs of the irrigation system, and the report emphasizes the necessity for their enlargement not only in size but also in the scope and development of their work, particularly in research. "New work and new ideas are the life of a scientific department." The growing demand of aviation urges expansion of the meteorological service and the value of instituting research in relation to agriculture and to the climatic causes of the Nile flood are quoted as immediate strong reasons for putting into effect the plans for the extension of its work. Nevertheless, a certain amount of research work is being carried on, including investigations of evaporation at Lake Qaroun and at Gebel Zeraf, and of swamp growths and silting at Aswân, Wadi Halfa and Khaunaq. It is unfortunate that these reports are not available until so long after the period to which they refer.

University Events

EDINBURGH.—The University has awarded the Dewar research fellowship to Dr. C. A. Beevers, lecturer in physics at University College, Hull, for three years from April 1. This is the first award of the fellowship, which was recently established under a bequest of Lady Dewar, widow of Sir James Dewar, for research in physics and chemistry, and on this occasion it has been given for research in crystallography.

OXFORD.—W. H. Cashmore, J. S. Wilson, R. K. Macdowall, and W. J. West have been appointed research officers by the Committee for Rural Economy.

In Congregation on February 8 the University Chest was authorized to set aside out of the Nuffield Trust funds a sum not exceeding £99,944 for the erection and equipment of a laboratory of physical chemistry.

A grant was also made towards the expenses of the University Expeditions of this year to the Cayman Islands and to Greenland.

Science News a Century Ago

Meteorology in America

AT a meeting of the Ashmolean Society at Oxford on February 12, 1838, a letter from Prof. Daubeny, dated at Philadelphia, was read. The letter contained a survey of the state of meteorological science in America and in it Daubeny stated that regular observations were made at Montreal by Mr. M'Cord, who had spared no expense in obtaining the best instruments, and that Mr. Webster, of Albany, from a table of mean temperatures of fifty-three places in the State of New York, had found the highest mean temperature in that State to be 51° and the lowest 43° F. Mr. Redfield, of New York, had advanced a theory that the prevailing storms on the Atlantic coasts have the same character as tornadoes and had prepared a chart to illustrate his views. The phenomena of these storms were explained by Mr. Espy, of Philadelphia, not by a gyratory motion, but by an upward current, which rushes in from all points of the compass towards a central point, where there is a rapid rise of the superficial strata of air into the higher regions of the atmosphere. Mr. Espy's views were stated at length and the letter also contained Daubeny's objections to them. The State of Pennsylvania, it was added, had allotted 4,000 dollars towards instruments for meteorological observations.

James Pollard Espy, who was born on May 9, 1786, and died on January 24, 1860, published his "Philosophy of Storms" in 1841. In 1843 he was appointed to the Washington Observatory, and while there he laid the foundation of the U.S. Weather Bureau.

A Letter from von Humboldt

ON February 12, 1838, at a meeting of the Royal Geographical Society, a letter from Alexander von Humboldt, dated Berlin, January 10, 1838, was read. In the course of the letter, von Humboldt referred to Schmoburgk's travels in Guiana, the work of M. Federoff who had spent five years in northern Asia, the trigonometrial survey between the Black Sea and the Caspian Sea, and to the subject of magnetic observations. Of the observations being made at Berlin, he said, "As we make observations here, both with the needle of Gambey, furnished with microscopes, and with the new apparatus of Gauss, furnished with a mirror, we have an opportunity of convincing ourselves more and more of the greater perfection of the latter apparatus, which by degrees will be employed in all our great observatories.

"As I think that the subject is not without importance to seamen, I beg you to invite the influential members of your Society to be good enough to propagate Gauss's manner of observing in all new stations where intelligent people can be found. Points near the magnetic equator and those which are in high latitudes in the southern hemisphere . . . would be most desirable if they would observe at the same epochs indicated by M. Gauss."

Richard Owen receives the Wollaston Medal

AT the anniversary meeting of the Geological Society held on February 16, 1838, at which Darwin was elected one of the secretaries, the president, the Rev. W. Whewell, in presenting the Wollaston Medal to Richard Owen, said: "Mr. Owen,—I have peculiar pleasure in presenting to you this medal, awarded to you by this Society, for your services to Fossil Zoology in general, and in particular for the description of the fossil mammalia collected by Mr. Darwin. I trust it will be a satisfaction to you to receive this our testimony of the success with which you have cultivated that great science of comparative zoology, to which you have devoted your powers. I trust it will add to your satisfaction, to consider that the subject which we more particularly wish to mark on this occasion—the Study of Fossil Zoology—is one to which the resources of your new science were applied, while the subject was yet new, by that great man—John Hunter—whose museum and whose reputation are so worthily consigned to your care. . . ."

Milne-Edwards on Annelidæ

"M. Milne-Edwards", said the *Athenæum* of February 17, 1838, "has been making some interesting and important observations on the circulating apparatus of the Annelidæ, which has been but little studied, excepting in the leech and earthworm. He finds a great diversity among the different genera. For instance in the Terebellæ, the branchiæ act as an arterial heart and organ of respiration. Among the Arenicolæ, the vascular tufts on the back equally fulfil the double functions of heart and branchiæ and there are besides two ventricles, which by their pulsations, send the blood into the dorsal vessel. In the Eunice, the course of the blood is determined by the contraction of a series of vesicles, situated on each side of the ventral vessel, and sending out canals which go to the branchiæ. These vessels are consequently little pulmonary hearts; and as a pair of them exists in almost all the rings of the body, these singular Annelidæ often possess hundreds of hearts."

Henri Milne-Edwards (1800–1885) was elected to the Paris Academy of Sciences in 1838 and afterwards filled the chairs of entomology, zoology and physiology at the Jardin des Plantes.

Societies and Academies

London

Royal Society (*Proc.*, A, **164**, 151–306; January 21).

R. W. GURNEY and N. F. MOTT: The theory of the photolysis of silver bromide and the photographic latent image.

D. R. HARTREE and W. HARTREE: Self-consistent field with exchange for calcium.

THEODORE DE KÁRMÁN and LESLIE HOWARTH: The statistical theory of isotropic turbulence.

H. J. A. DARTNALL, C. F. GOODEVE and R. J. LYTHGOE: Effect of temperature on the photochemical bleaching of visual purple solutions.

KRISHNA CHANDRA: Instability of fluids heated from below.

T. BJERGE: Production of neutrons by bombardment of beryllium with α-particles.

H. J. BHABHA: The penetrating component of cosmic radiation.

E. A. MOELWYN-HUGHES: Hydrolysis of the methyl halides.

Proc., B, **124**, 397–521; January 14.

D. KEILIN and E. F. HARTREE: The mechanism of the decomposition of hydrogen peroxide by catalase.

J. W. HUGHES: The monaural threshold: effect of a subliminal contralateral stimulus.

P. D. F. MURRAY: Control of beating and of microfibrillation by means of potassium, calcium and sodium in the chick embryo heart. Calcium fibrillation and the control of beating.

E. WATCHORN and P. D. F. MURRAY: Loss of potassium from embryonic chick hearts in potassium-free media with and without calcium.

R. B. HAINES: Effect of freezing on bacteria.

T. MCKEOWN and S. ZUCKERMAN: Suppression of œstrus in the rat during pregnancy and lactation.

S. J. FOLLEY and S. K. KON: Effect of sex hormones on lactation in the rat.

I. W. ROWLANDS: Pro-gonadotropic sera. Specificity of antigonadotropic sera.

Paris

Academy of Sciences, December 27 (*C.R.*, **205**, 1333–1476).

ALFRED LACROIX: The nature of the deposit of zircon of Mont Ampanobe in Madagascar.

H. DESLANDRES: The universal constant of band spectra. The attribution of the lines of the band to causes other than the rotation of the molecule.

GEORGES GIRAUD: A new method for treating certain problems relating to equations of the elliptic type.

HENRI DEVAUX: The instantaneous disclosure of monomolecular films spread out on mercury by the formation of a mist.

MARC KRASNER: Rectification of the author's earlier note on the definition of certain non-commutative rings.

PAUL DUBREIL and MME. MARIE LOUISE DUBREIL-JACOTIN: The algebraic properties of the relations of equivalence. The theorems of Schreier and of Jordan-Hölder.

J. LE ROUX: The analytical definition of equality in geometry.

R. DE MISÈS: The geometric basis of the theorem of Mandelbrojt on the singular points of an analytical function.

PAUL LÉVY: Certain solutions of Chapman's equation.

DRAGOSLAV S. MITRINOVITCH: A problem on asymptotic lines and the method of logical integration of the differential equations of Jules Drach.

STEFAN BERGMANN: A connexion between the theory of partial differential equations and that of analytical functions of a variable.

CARLOS BIGGERI: A general theorem on the peripheral singularities of the series of Dirichlet.

CAÏUS JACOB: The approximate calculation of the coefficient of contraction of a gaseous jet.

JACQUES YVON: The tensorial equations of the magnetic electron.

ROBERT PINOIR: A method of measuring the densities of electrostatic charges. The method described, in which the measurement of the electrostatic charge is reduced to the measurement of a rectified current, is applicable to the study of the electrification produced in the manufacture of paper and of films.

MLLE. SUZANNE VEIL: The opposition of metals to platinum in solutions of their own salts. Study of the changes of E.M.F. produced in the cell copper–cupric chloride solution – platinum by dilution.

STÉFAN PROCOPIU and GÉRARD D'ALBON: The magnetic permeability at high frequency of thin layers of iron electrolytically deposited.

PIERRE GRAUWIN: Characteristics of the thermo-electronic emission of thoriated molybdenum.

JEAN PAUL MATHIEU and MLLE. N. FARAGGI: The study of the circularly polarized light reflected by certain Coleoptera.

ROGER ARNOULT: The intensity of the principal electronic lines of conversion of the active deposit of thoron and on the photographic efficiency of the electrons.

JEAN THIBAUD and MARTIN FERBER: The independence of the disintegrations of the polonium atoms.

PIERRE BRUN: Study of the properties of metallic ions in alcohol. Measurements of the decomposition potentials and mobilities of the sodium and potassium ions of sodium and potassium ethylate in alcohol.

GEORGES CHAMPETIER and RODOLPHE VIALLARD: The penetration of water into the cellulose network. The exchange reaction between cellulose and heavy water.

MATHIEU DOBINE: The adsorption by blood charcoal of the system acetic acid – water.

ENRIQUE MOLES: The adsorption correction in the method of limiting densities.

WILFRIED HELLER and MLLE. GERMAINE QUIMPE: The influence of an orientation of non-spherical colloidal particles on their velocity of aggregation.

EDOUARD RENCKER: The tempering and annealing of boric anhydride glass.

ROGER MICHAUD: The law of the precipitation of the β phase by reheating an aluminium-magnesium alloy containing 12·7 per cent of magnesium. The changes produced by reheating a tempered aluminium magnesium alloy at varying temperatures were studied by means of X-ray diffraction.

JEAN AMIEL: The cupritrichlorides and cupritribromides.

ANDRÉ CHRÉTIEN: A simple method for determining directly the mass of gaseous bodies under normal conditions.

[To be continued]

Brussels

Royal Academy (*Bull. Classe Sci.*, **23**, No. 10; 1937).

T. DE DONDER: Components of a chemical reaction.

E. DE WILDEMAN: Abortion of the ovaries in certain phanerogams.

J. L. VERHAEGE: Intensity relationships of some intercombination lines in the spectrum of mercury. Considerable discrepancies between the observed and calculated intensity ratios were found for the lines ($7^3S_1 - 6^3P_2$), ($7^3S_1 - 6^3P_1$) and ($7^3S_1 - 6^3P_0$).

L. DERWIDUÉ: Some birational hyperspatial transformations.

R. DEBEVER: Mayer fields in the calculus of variations of multiple integrals.

H. SCHOTS: Two interesting problems in the calculation of magic squares.

F. E. NISOLI: Reply to Mr. Cox's remarks concerning a note of May 4, 1937.

Moscow

Academy of Sciences (*C.R.*, **17**, No. 5, 1937).

N. P. ERUGIN: Exponential substitution for an irregular system of linear differential equations.

I. GELFAND: (1) Theory of abstract functions. (2) Operators and abstract functions.

V. FABRIKANT: Probability of collisions of the second kind between atoms and free electrons.

I. N. ANTIPOV-KARATAJEV and I. D. SEDLECKIJ: Genesis of colloidal metals in alkaline soils. Gedroitsite, a new mineral.

B. A. RUBIN and O. T. LUTIKOVA: Oxidizing-reducing activity of tissues, as a biological character in plants.

D. J. VAKULIN: Effect of low and varying temperatures on variability in *Perilla*.

A. A. DROBKOV: Influence of rare earths on plant growth.

M. MOISEJEVA: Application of the quantitative anatomical method to the division of the genus *Pinus* into smaller taxonomic units.

S. N. JAGUŽINSKIJ: Structure of species of protococcous algæ, *Scenedesmus* Meyen.

Tokyo

Imperial Academy (*Proc.*, **13**, No. 9; 1937).

OBITUARY notice of Prof. Toyokichi Takamatsu, known for his work in chemical industry in Japan.

MASAO SUGAWARA: The transformation theory of Siegel's modular group of the nth degree.

YUKIYOSI KAWADA: Remarks on M. Moriya's construction of the classes of group theories of algebraic functions.

TAKESHI INAGAKI: The classes of constituents of complementary analytical groups.

TOKUI SATÔ: The differential equation $y'' = f(x, y, y')$.

MASAO INOUYE: A consideration of the problem of Dirichlet.

TOKIO TAKÉUCHI and TAKANOSUKE SUGITA: A method of producing a photographic image of a dark hot body in darkness. The method adopted involves the quenching of phosphorescence by infra-red light.

SHINKICHI YASHIMURA: Limnology of two lakes on the oceanic island, Kita-Daitô-zima.

MASUZÔ UENO: Plankton of the lakes in Kita-Daitô-zima.

TOKIO SHIKAMA: Ossiferous fissure deposits of Kuzuii Totigi Prefecture.

KIYOSHI TAKEWAKI: (1) Fate of the zona reticularis in the adrenal cortex of castrated male mice. In certain circumstances, the zona reticularis remains for a year and a half (sometimes longer) after castration; but various types of degenerative phenomena occur in the zone of males which have long been castrated. (2) Postponement of appearance of œstrus following interruption of pregnancy in lactating mice. Lactation inhibits for some time the advent of œstrus following the removal of the uterus containing fœtuses.

TAKEO KAMADA and HARUO KINOSITA: Graded response of the muscle of the Japanese giant crab to indirect stimulation.

YOSITIRO UMEYA: Preliminary note on experiments of ooplasm transfusion of silkworm eggs, with special reference to the embryo. Whether or not the development of the embryo in the wintering egg will begin depends upon the solubility of the yolk, and the phenomenon of egg-wintering is shown to be based primarily on the ooplasm and not on the embryo.

Forthcoming Events

Monday, February 14

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith, F.R.S.: "The Prehistoric People of Mount Carmel".

ROYAL GEOGRAPHICAL SOCIETY, at 5.—J. Hanson-Lowe: "The Structure of the Lower Yangtze Terraces".

Wednesday, February 16

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Dr. W. E. Gye: "Some Recent Work on Experimental Cancer Research".

Thursday, February 17

CHEMICAL SOCIETY, at 8.—Prof. A. Findlay: Franklin Memorial Lecture.

Friday, February 18

INSTITUTION OF CHEMICAL ENGINEERS (at the Hotel Victoria, Northumberland Avenue, London, W.C.2).—Annual Corporate Meeting.

Dr. William Cullen: "A Milestone" (Presidential Address).

ROYAL INSTITUTION, at 9.—Prof. E. N. da C. Andrade, F.R.S.: "Science in the Seventeenth Century".

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

ASSISTANT (grade III) IN THE BALLISTICS DIRECTORATE and a JUNIOR SCIENTIFIC OFFICER IN THE RADIOLOGICAL DIRECTORATE of the Research Department, Woolwich, S.E.18—The Chief Superintendent (February 14).

LECTURER IN MECHANICAL ENGINEERING in the Leeds College of Technology—The Director of Education, Education Department, Calverley Street, Leeds 1 (February 16).

JUNIOR SCIENTIFIC OFFICER at the Air Defence Experimental Establishment, Biggin Hill, Kent—The Superintendent (February 18).

ASSISTANTS (grades II and III—refs. 6070 and 6270) at the Royal Aircraft Establishment, South Farnborough, Hants—The Chief Superintendent (February 19).

LECTURER (woman) IN GEOGRAPHY in the Goldsmiths' College, New Cross, S.E. 14—The Warden (February 28).

ASSISTANT GOVERNMENT ANALYSTS in the Straits Settlements—The Director of Recruitment (Colonial Service), 8 Buckingham Gate, London, S.W.1 (March 21).

TWO DEMONSTRATORS IN PHYSIOLOGY in the University of Liverpool—The Registrar (April 1).

Reports and other Publications

(not included in the monthly Books Supplement)

Great Britain and Ireland

Chapters in the Development of Industrial Organic Chemistry. Pp. 112+10 plates. (London: Imperial Chemical Industries, Ltd.) [121

University of London Council for Psychical Investigation. Bulletin 3: Preliminary Studies of a Vaudeville Telepathist. By S. G. Soal. Pp. 96+6 plates. (London: University of London Council for Psychical Investigation.) 5*s*. net. [131

National Physical Laboratory. Abstracts of Papers published in the Year 1936. Pp. iii+65. (London: H.M. Stationery Office.) 1*s*. net. [191

The Journal of the Institute of Metals. Vol. 61. Edited by G. Shaw Scott. Pp. 332+29 plates. (London: Institute of Metals.) [191

Department of Scientific and Industrial Research: Water Pollution Research. Summary of Current Literature. Vol. 11, No. 1, January 1938, Abstracts Nos. 1–123. Pp. ii+36. (London: H.M. Stationery Office.) 2*s*. net. [191

Forensic Chemistry in the Criminal Courts. By Dr. C. Ainsworth Mitchell. Pp. 17. (London: Institute of Chemistry.) [191

University of Leeds in association with the Royal Bath Hospital, Harrogate, and the Leeds Public Dispensary and Hospital. Annual Report of the Advisory Committee on Research into Rheumatism. Pp. 6. (Leeds: The University.) [191

Lunacy and Mental Deficiency. The Twenty-third Annual Report of the Board of Control for the Year 1936. Part 2. Pp. iii+540. (London: H.M. Stationery Office.) 8*s*. net. [191

Department of Scientific and Industrial Research. Report of the Road Research Board, with the Report of the Director of Road Research, for the Year ended 31st March, 1937. Pp. viii+120. (London: H.M. Stationery Office.) 3*s*. net. [191

Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), Nos. 54 and 55: A Method for determining the Radium Content of Rocks by direct Alpha-Ray Counting, by Dr. J. H. J. Poole; The Theoretical Efficiency of Cylindrical Ionisation Chambers when used for estimating Radon by Alpha Particle Counting, by Dr. J. H. J. Poole. Pp. 595–614. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) 2*s*. [191

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1782 (2924): Calculated Flexural-Torsional Flutter Characteristics of some Typical Cantilever Wings. By Dr. W. J. Duncan and H. M. Lyon. Pp. 32. 4*s*. 6*d*. net. No. 1786 (2943): A Review of Theoretical Investigations of the Aerodynamical Forces on a Wing in Non-uniform Motion. By H. M. Lyon. Pp. 33. 4*s*. 6*d*. net. No. 1792 (2317): Note on the Drag of a Gauntlet as measured in the 24 ft. Tunnel. By W. G. Jennings. Pp. 8. 1*s*. 6*d*. net. (London: H.M. Stationery Office.) [191

Ministry of Agriculture and Fisheries: Fisheries—England and Wales. Salmon and Freshwater Fisheries Report for the Year 1936. Pp. 53+3 plates. (London: H.M. Stationery Office.) 1*s*. net. [191

Fourth International Grassland Congress, Great Britain, 1937. Report containing Full Texts of all Papers delivered to the Congress at Aberystwyth on July 15, 16 and 17, 1937. Edited for the Organizing Committee by R. O. Whyte. Pp. x+486+xi+xxxiv. (Aberystwyth: Fourth International Grassland Congress.) 40*s*. [191

Other Countries

The South African Journal of Science. Vol. 34: Being the Report of the South African Association for the Advancement of Science, 1937, Windhoek. Pp. xliv+464. (Johannesburg: South African Association for the Advancement of Science.) 30*s*. net. [181

University of California Publications in American Archæology and Ethnology. Vol. 36, No. 4: The Tolowa and their Southwest Oregon Kin. By Philip Drucker. Pp. 221–300. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) 4*s*. 6*d*. net. [191

Anthropological Records. Vol. 1, No. 1: Culture Element Distributions. 5: Southern California. By Philip Drucker. Pp. iii+52. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) 2*s*. 3*d*. net. [191

Scientific Reports of the Imperial Agricultural Research Institute, New Delhi, for the Year ending 30th June, 1937, with a Brief Survey of Three Decades of Research at the Institute. Pp. iv+177+8 plates. (Delhi: Manager of Publications.) 3 rupees; 5*s*. 3*d*. [191

Verhandlungen der Schweizerischen Naturforschenden Gesellschaft. 118 Jahresversammlung vom 27 bis 29 August 1937 in Genf. Pp. 380+37. (Aarau: H. R. Sauerländer und Co.) [191

Regenwaarnemingen in Nederlandsch-Indië. Acht en vijftigste Jaargang, 1936. Pp. 129. (Batavia: Koninklijk Magnetisch en Meteorologisch Observatorium.) [191

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 158: Further Studies of the Ground Effect on the Aerodynamic Characteristics of an Aeroplane, with Special Reference to Tail Moment. By Itirô Tani, Hideo Itokawa and Masuo Taima. Pp. 115–146. (Tôkyô: Kôgyô Tosho Kabushiki Kaisha.) 40 sen. [191

South Australia. Annual Report of the Director of Mines and Government Geologist for 1936. Pp. 8. (Adelaide: Government Printer.) [191

Annalen van de Sterrewacht te Leiden. Deel 17, Stuk 2: Photographic Photometry of Variable Stars in the Globular Cluster ω Centauri, based on Plates taken by H. Van Gent with the Yale Refractor at Johannesburg, measured by C. J. Kooreman and W. Chr. Martin. Discussed by W. Chr. Martin. Pp. 166+2 plates. (Leiden: Sterrewacht.) [191

New Zealand: Department of Lands and Survey. Annual Report on Scenery Preservation for the Year ended 31st March 1937. Pp. 19+5 plates. (Wellington: Government Printer.) 1*s*. [191

Josiah Macy, Jr. Foundation. A Review by the President of the Activities for the Six Years ended 31st December, 1936, with Extracts from the Treasurer's Reports for the Years 1932–1936. Pp. 137. (New York: Josiah Macy, Jr. Foundation.) [191

Australasian Antarctic Expedition, 1911–14. Scientific Reports. Section C: Zoology and Botany. Vol. 2, Part 1: Mallophaga and Siphunculata. By the late Prof. Launcelot Harrison. Pp. 47+3 plates. 6*s*. Vol. 8, Part 4: Crinoidea. By Austin H. Clark. Pp. 18. 3*s*. Vol. 10, Part 1: Trematoda. By Prof. T. Harvey Johnston. Pp. 29. 4*s*. (Sydney: Government Printer.) [191

Bulletin of the American Museum of Natural History. Vol. 74, Art. 3: Studies of Birds from Eastern Brazil and Paraguay, based on a Collection made by Emil Kaempfer. By Elsie M. B. Naumburg. Pp. 139–205. Vol. 74, Art. 4: Observations on the Body Form of the Blue Marlin (*Makaira nigricans ampla* Poey). By G. Miles Conrad and Francesca La Monte. Pp. 207–220. (New York: American Museum of Natural History.) [191

U.S. Department of Agriculture. Circular No. 445: The Iris Thrips and its Control by Hot Water, with Notes on other Treatment. By Floyd F. Smith and L. G. Utter. Pp. 12. 5 cents. Farmers' Bulletin No. 1783: Feeding Wildlife in Winter. By Wallace B. Grange. Pp. ii+21. 5 cents. (Washington, D.C.: Government Printing Office.) [191

U.S. Department of the Interior: Office of Education. Leaflet No. 33: Housing and Equipment of School Libraries. Compiled by Ellen L. Anderson. Pp. 11. 5 cents. Vocational Education Leaflet No. 2: Suggestions for Teaching the Job of Controlling Bunt (Stinking Smut) of Wheat in Vocational Agriculture Classes. Revised edition. Pp. iv+12. 5 cents. (Washington, D.C.: Government Printing Office.) [191

U.S. Department of Commerce: National Bureau of Standards. Handbook H 21: Code for Protection against Lightning. Parts 1, 2 and 3. (Supersedes M92 and H17.) Pp. x+96. (Washington, D.C.: Government Printing Office.) 15 cents. [191

Proceedings of the United States National Museum. Vol. 84, No. 3025: A Giant New Species of Fairy Shrimp of the Genus Branchinecta from the State of Washington. By James E. Lynch. Pp. 555–562+plates 77–80. (Washington, D.C.: Government Printing Office.) [191

University of California Publications in Zoology. Vol. 42, No. 1: Structural Modifications in the Hawaiian Goose (*Nesochen sandvicensis*): a Study in Adaptive Evolution. By Alden H. Miller. Pp. iii+80+4 plates. 1 dollar. Vol. 42, No. 2: Morphology of the Pocket Gopher Mammalian Genus Thomomys. By John Eric Hill. Pp. iii+81–342. 1 dollar. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) [191

II Internationaler Kongress für Krebsforschung und Krebsbekämpfung (IInd International Congress of Scientific and Social Campaign against Cancer). 2: Mitteilungen (Communications). Pp. xii+625. (Bruxelles: Marcel Hayez.) [231

Contributions from the Physical Laboratories of Harvard University for the Year 1936. Series 2, Vol. 3. Pp. vi+48 papers. (Cambridge, Mass.: Harvard University.) [231

Smithsonian Miscellaneous Collections. Vol. 97, No. 3: Middle Cambrian Fossils from Pend Oreille Lake, Idaho. By Charles Elmer Resser. (Publication 3447.) Pp. 12+1 plate. (Washington, D.C.: Smithsonian Institution.) [231

U.S. Department of Agriculture. Leaflet No. 152: How to Control Fleas. By F. C. Bishopp. Pp. 4. (Washington, D.C.: Government Printing Office.) 5 cents. [231

Proceedings of the United States National Museum. Vol. 85, No. 3028: Synopsis of the Beetles of the Chilean Genus Phytholaema (Scarabæidæ: Melolonthinæ). By Lawrence W. Saylor. Pp. 5–12. Vol. 85, No. 3029: Redescription of the Capelin *Mallotus catervarius* (Pennant) of the North Pacific. By Leonard P. Schultz. Pp. 13–20. (Washington, D.C.: Government Printing Office.) [231

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